SEPTEMBER 7, 1953

Electrical World

Price 35 Cents

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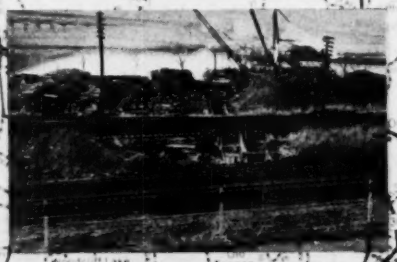
10 Municipalities . . .



7 Railroads . . .

7 Bridges . . .

3 River Beds . . .

Are Crossed by 130 Kv Pipe Type Cable in New Jersey

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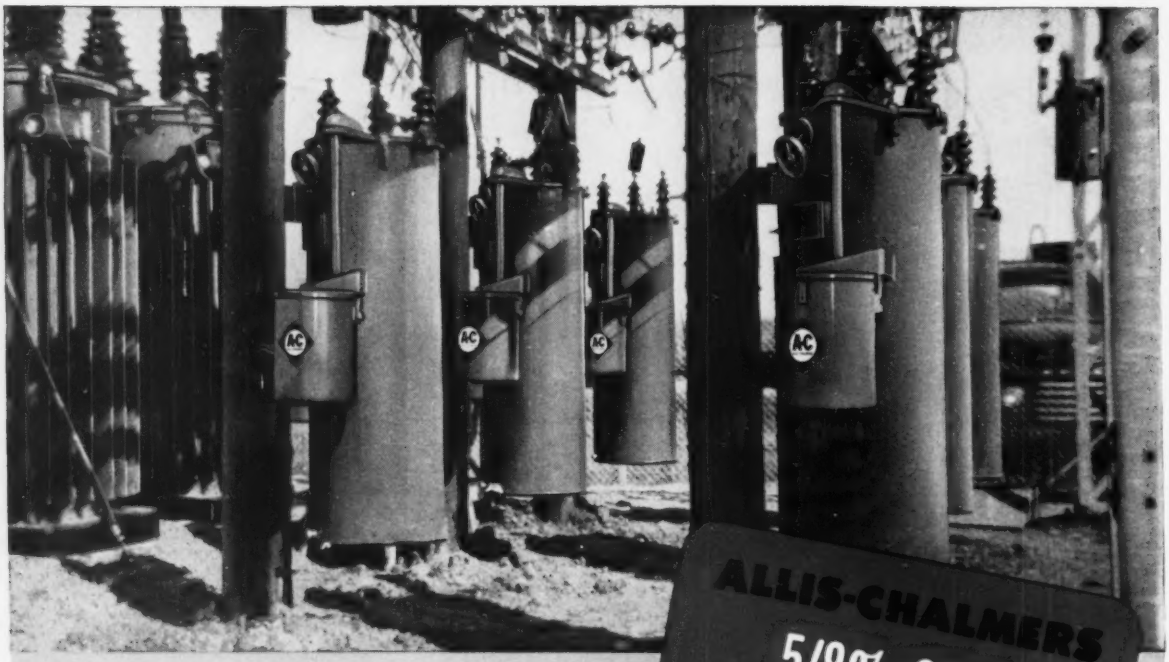
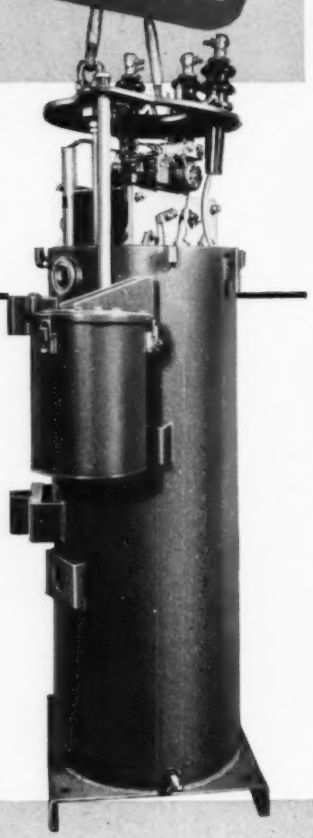


ALLIS-CHALMERS
5/8% STEP
VOLTAGE REGULATORS

How a Regulator Adds Profits 2 Ways



1 **By Increasing System Revenue.** You get an accurate ± 1 volt band over 20% range of regulation when you apply Allis-Chalmers distribution regulators to your loads. No more trouble from low voltage during peak loads; maximum profits from your system at all times. Best of all, your customers are more satisfied — service calls due to low voltage can be practically eliminated.

2 **By Holding Future Service Costs to a Minimum.** Thanks to unit construction, you are assured of practically trouble-free operation with Allis-Chalmers distribution regulators. High quality workmanship is assured by constructing as an integral unit: bushings, cover, transformer, mechanism, and control. All connections are made and inspected *before* tanking. Same feature simplifies future inspection and maintenance by making untanking easy, permitting operation of regulators outside of tank without making special connections. For more facts, call your nearby A-C district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4106

RATINGS AVAILABLE	7620 Volts—15, 50, 100 amp 5000 Volts—50, 100 amp 2500 Volts—100, 200 amp

ALLIS-CHALMERS

Originators of 5/8% Step Regulation

Meet this Week's Writers

CARMICHAEL STARRS

Describing Public Service Electric & Gas Co's new 185,000 kva pipe-type cable in this issue are E. T. Carmichael and T. E. Starrs. The former has been with the utility for about 30 years. He is a graduate of Lehigh University, married, and does vegetable farming in Sparta, N. J. in his spare hours. His co-author joined Public Service in 1936 after duty with Western Electric Co. A graduate of the Newark College of Engineering, he is married, and the father of two girls. During his leisure hours, he putters around in the workshop of his Nutley, N. J. home.

HENDRICKSON RYDBECK

Enlarging upon expanding capacitor frontiers on pages 86 to 89 are P. E. Hendrickson and V. A. Rydbeck of the General Electric Co. Hendrickson, an application engineer, joined GE four years ago, after graduation from the University of Colorado. A native of Denver, he is married and has two children. Rydbeck has been with GE since 1943, having worked between 1936 and 1940 with Commonwealth Edison Co. Now manager, sales analysis, apparatus products, he is a graduate of the University of Illinois. He is married and the father of three sons, aged five, three, and one. His hobbies include amateur movies, gardening, and tennis.

Electrical World

Published for 79 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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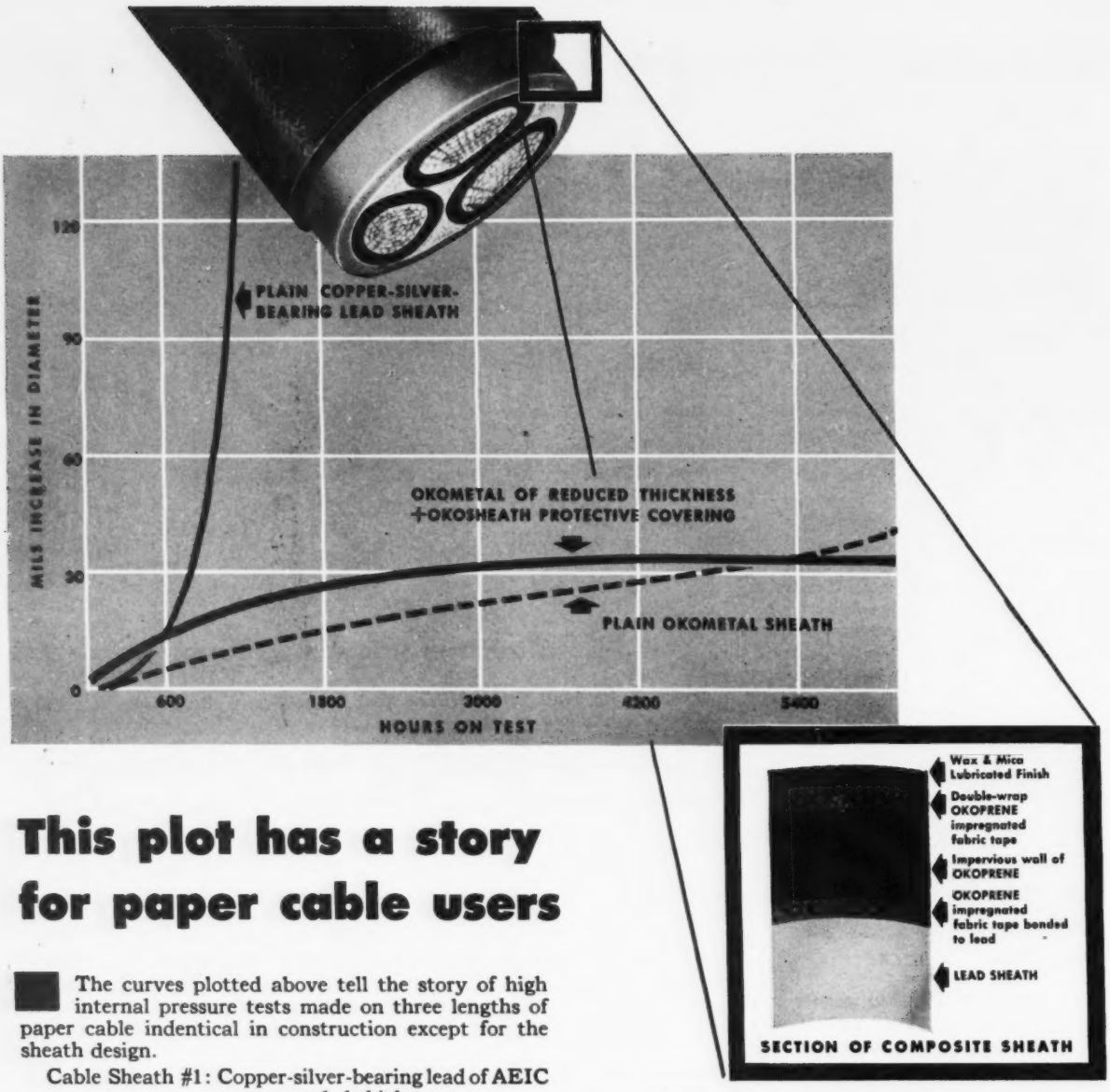


This plot has a story for paper cable users

The curves plotted above tell the story of high internal pressure tests made on three lengths of paper cable indentical in construction except for the sheath design.

Cable Sheath #1: Copper-silver-bearing lead of AEIC recommended thickness

Cable Sheath #2: Okometal alloy of AEIC recommended thickness

Cable Sheath #3: Composite design with Okometal alloy of two-thirds AEIC thickness plus Okosheath Protective Covering

Sheath #1, having the least resistance to internal pressure, started to "neck down" or thin-out at one spot, which led to a rapidly increasing expansion and failure after only 1152 hours on test. Sheath #2, made with unprotected Okometal of full AEIC thickness, was still on test after 6000 hours, indicating its superiority over a conventional lead sheath. Composite sheath #3, made with Okometal of reduced thickness but having an Okosheath Protective Covering, was not only still on test after 6000 hours, but also showed a flat curve that indicated the highest degree of stability with no tendency to "neck down."

Along with the advantages disclosed above, the composite sheath construction of Okometal plus Okosheath Protective Covering possesses superior resistance to scoring during installation and eliminates both chemical and electrolytic corrosion. These features are fully discussed in Bulletin EW-1047, available upon request from The Okonite-Callender Cable Company, Passaic, New Jersey.

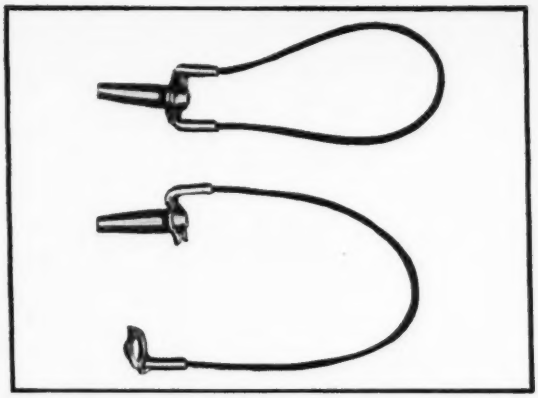
1721

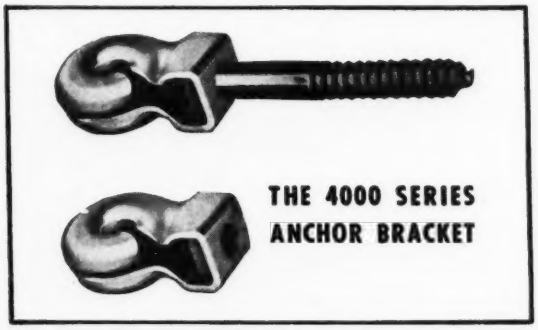
OKONITE insulated cables

75th ANNIVERSARY

Electroline AUTOMATIC DEAD-END

for Neutral Supported Multiple Conductor Service-Drop Cable





THE 4000 SERIES ANCHOR BRACKET

This Electroline Automatic Dead-End is designed for use with neutral-supported type of service drop. The insulation on the phase wires is not destroyed because these Dead-Ends grip only the bare neutral. This eliminates the possibility of shorting any phase. Available only for No. 6-AWG conductor. For automatic line Dead-Ends use the Electroline 3400 Series.

THE ELECTROLINE 3800 SERIES Automatic Dead-Ends lower construction costs because they are easily installed in a few seconds. This Dead-End is assembled as a one-piece unit with no loose parts to be dropped or lost. One end of the flexible bail is detachable for use with a spool-type insulator or other types of supporting anchorages now in service. This feature permits quick and easy installation with only one part, other than the conductor, to be handled by the lineman.

ELECTROLINE 4000 ANCHOR BRACKET — The 4000 Series Service Bracket, for use on permanently multi-grounded neutral systems (ideal for use with 3800 Series Dead-Ends as illustrated below), permits quick and simple insertion of a closed bail or loop—supports the cable at any angle. Installation costs are further reduced since this method of anchoring eliminates the insulator and insulator hardware.

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separates arcing terminals quickly and positively

CO_2 GAS BOMB

for quick interruption of low current faults

UPPER STRESS CONE

withstands high recovery voltage

ARC EXTINGUISHER CHAMBER

where the arc is drawn and extinguished

BORIC ACID LINING

in arc extinguishing chamber. Packed under 6,000 pounds pressure

FUSIBLE ELEMENT

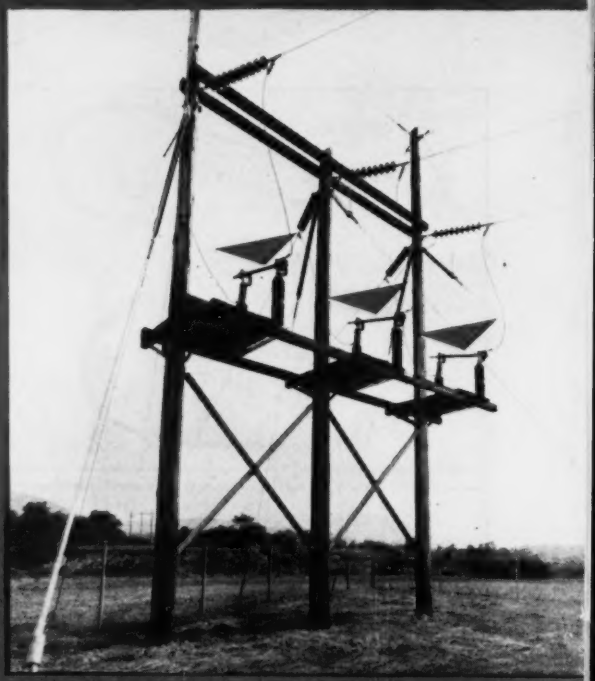
(made of silver, helically coiled), retains its time-current characteristics permanently because it cannot be damaged by vibration, age, lightning, or other current surges

CORONA SHIELD

protects fusible elements from corona damage

LOWER STRESS CONE

withstands high recovery voltage and confines arc core within fuse tube



Three horizontal 115 KV S&C Power Fuses, Type SMD-2, installed at a sectionalizing point.

Three 69 KV S&C Power Fuses, Type SMD-2, protecting transformer primaries.

S&C

SPECIALISTS IN HIGH-VOLTAGE

are Fully Equal to the Best-Engineered Circuit-Interrupting Devices of ANY Type

SPECIFICALLY, THIS MEANS THE ABILITY TO...

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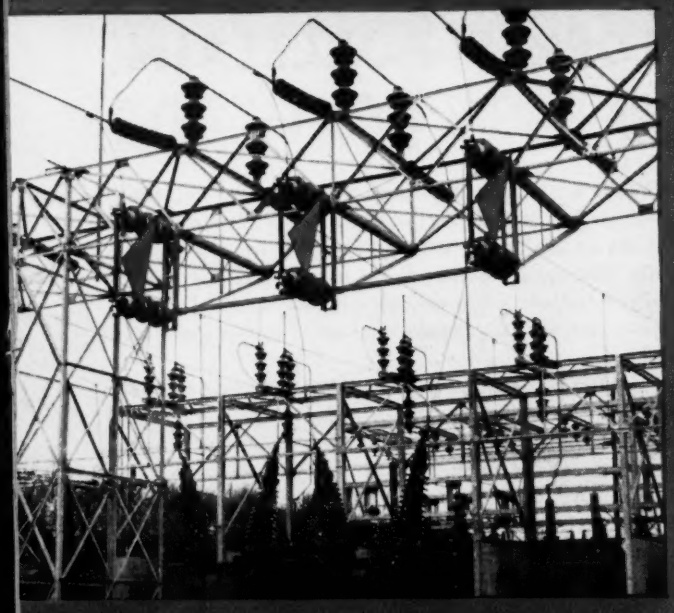
- Clear the circuit of any fault with precision without prolonged arcing or flashovers that lead to phase-to-phase faults or other consequences



Forty years of intensive engineering and research have developed S&C Power Fuses to a point where today they are as completely reliable as the most advanced circuit-interrupting device, regardless of type.

To achieve this success, S&C engineers threw out all previous notions about current-responsive techniques and circuit interruption, and started fresh.

Entirely new concepts were evolved and refined, until today the reliability of S&C Power Fuses is so well established that the leading electric utilities trust them completely to protect valuable installations and maintain dependable service. They are using S&C Power Fuses with outstanding success where fuses never have been used before.

Probably S&C Power Fuses are the answer to your protection problems. Why not write for full information, today?

Write for Catalog Section 262

which gives a complete description of SMD-2 Power Fuses, including applications and ratings.

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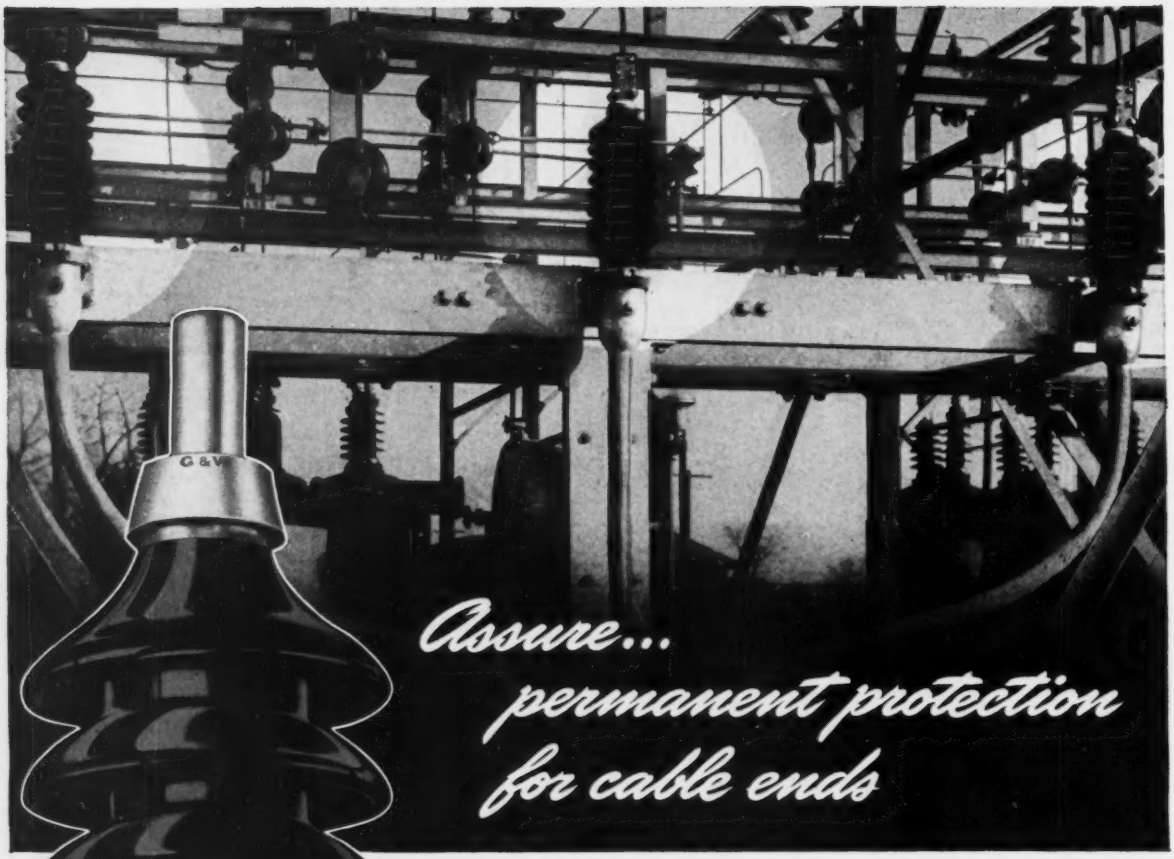
CIRCUIT INTERRUPTION



SOLDERED PORCELAIN
TYPE "ST" POTHEADS

These potheads are factory assembled, with metal-to-porcelain soldered joints. This method (exclusive with G & W) completely eliminates the possibility of future trouble due to loosely gasketed joints. When these potheads are used, the responsibility for properly sealed joints rests entirely with our factory. Troubles due to aging, cold flow and permanent set of gasket materials are eliminated.

Since their introduction in 1940, type "ST" Soldertite potheads have achieved an excellent service record on gas filled as well as standard cables. Many electric utilities companies have standardized the use of them.

Bulletin No. AA50 gives further information, data and prices.

Bulletin No. A52 explains the theory of stress cones and gives data on make-up as well as prices of material.

Write for your copies or ask your representative.

G & W ELECTRIC SPECIALTY CO.
7780 DANTE AVE., CHICAGO 19, ILL., U.S.A.
Cable terminating, connecting and sectionalizing devices
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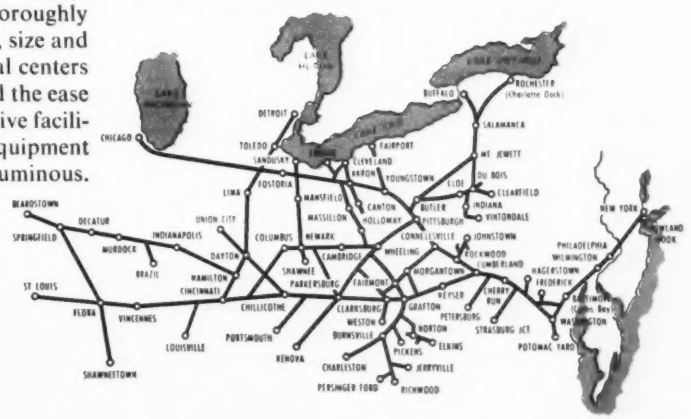
Many varieties of non clinkering coals ideal for stoker use and hand firing
Always ready to serve you...

with a coal that's exactly right

Name your choice—in "Bituminousland" along the Baltimore & Ohio, we have it! Here Nature has stored a supply of economical heat and energy sufficient to last for centuries.

B&O Bituminous coals exist in wide variety. The mines that produce them are thoroughly mechanized so that costs are kept low, size and quality uniform. Nearness to industrial centers results in low transportation costs, and the ease of storing removes the need for expensive facilities. Furthermore, new methods and equipment have increased the burning value of Bituminous.

ASK OUR MAN! Let him direct you to the best coal for your needs, and explain proper firing methods. You'll be more than pleased at the improved efficiency, economy, and cleanliness of B&O Bituminous.



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BALTIMORE & OHIO RAILROAD

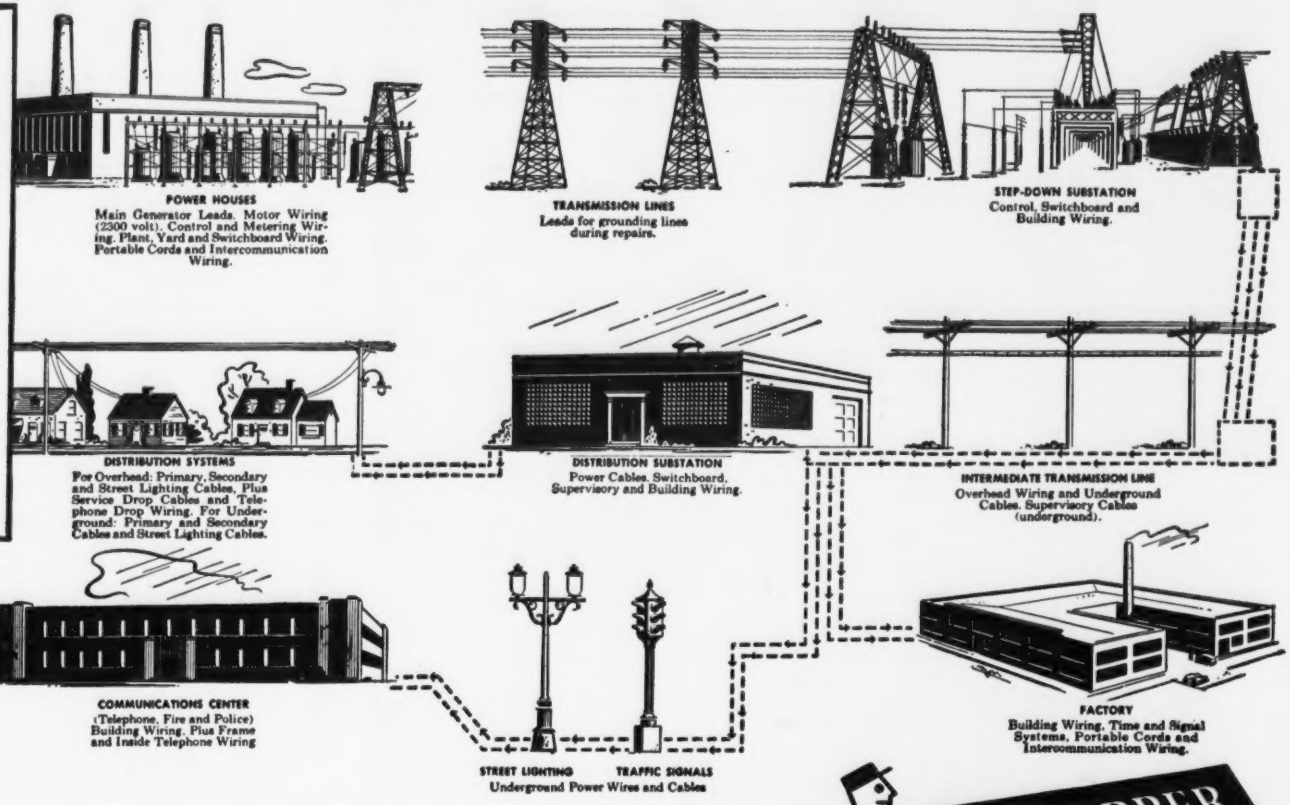
Constantly *doing things*—better!

You can solve any power puzzle

with U. S. Rubber Electrical Wires and Cables

For over 60 years United States Rubber Company has been manufacturing electrical wires and cables. Today, the range of these "U. S." products contains the answer to almost any wiring problem you may meet.

U. S. Rubber pioneered in developing Laytex® insulation made of 90% pure natural unmilled grainless rubber. From U. S. Royal Cables, Royal Master Portable Cords and Grizzly Underground Cables to Uskorona corona-resistant cable, the U. S. Rubber line includes utility wires and cables of every description, including cables fitted to IMSA specifications for traffic, fire and police needs.


POWER HOUSES
Main Generator Leads, Motor Wiring (2300 volt), Control and Metering Wiring, Plant, Yard and Switchboard Wiring. Portable Cords and Intercommunication Wiring.
TRANSMISSION LINES
Leads for grounding lines during repairs.
STEP-DOWN SUBSTATION
Control, Switchboard and Building Wiring.
DISTRIBUTION SYSTEMS
For Overhead: Primary, Secondary and Street Lighting Cables, Plus Service Drop Cables and Telephone Drop Wiring. For Underground: Primary and Secondary Cables and Street Lighting Cables.
DISTRIBUTION SUBSTATION
Power Cables, Switchboard, Supervisory and Building Wiring.
INTERMEDIATE TRANSMISSION LINE
Overhead Wiring and Underground Cables. Supervisory Cables (underground).
FIRE ALARM SYSTEMS
POLICE CALL SYSTEMS
Underground Communication Wires and Cables
COMMUNICATIONS CENTER
(Telephone, Fire and Police) Building Wiring, Plus Frame and Inside Telephone Wiring
STREET LIGHTING
TRAFFIC SIGNALS
Underground Power Wires and Cables
FACTORY
Building Wiring, Time and Signal Systems, Portable Cords and Intercommunication Wiring.

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Electrical Wire and Cable Department, Rockefeller Center, New York 20, N. Y.

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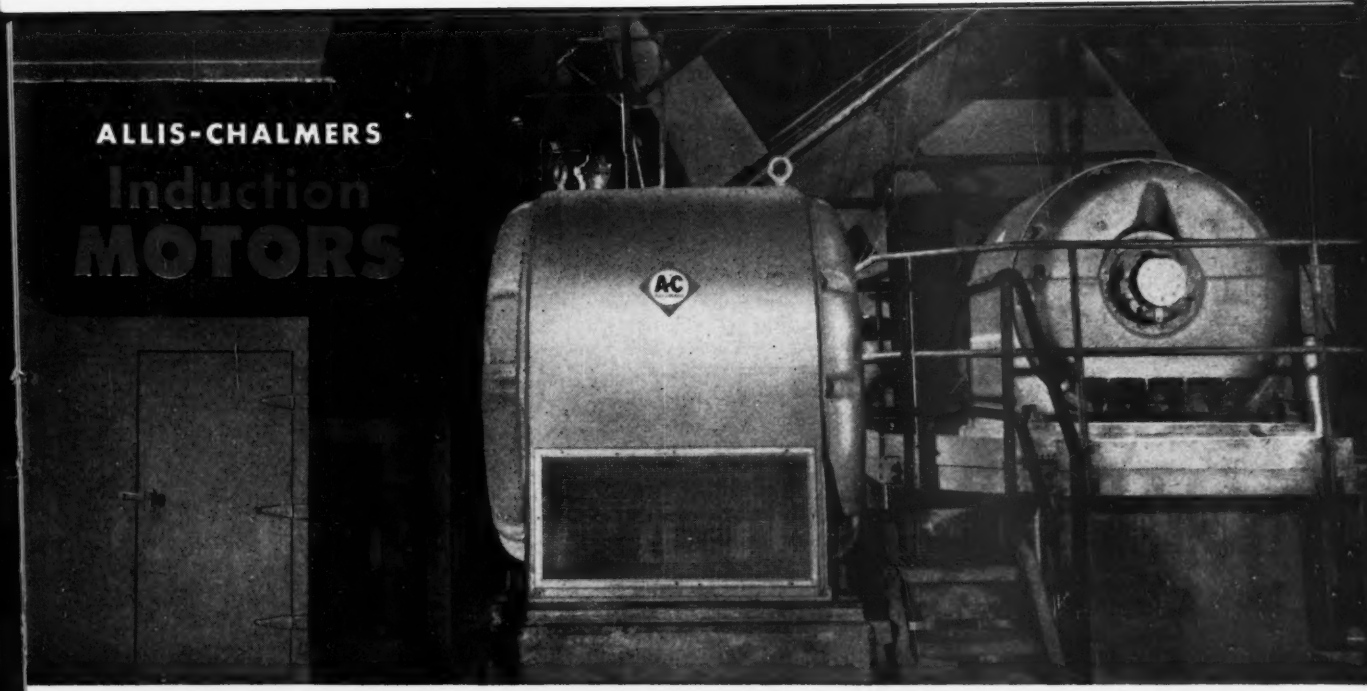


Left to right (above) are drip-proof, silicone insulated, 1000-hp, forced and induced-draft fan motors for unit No. 2. Forced draft fan motors for unit No. 3 will be of the weather-protected type for installation outdoors.

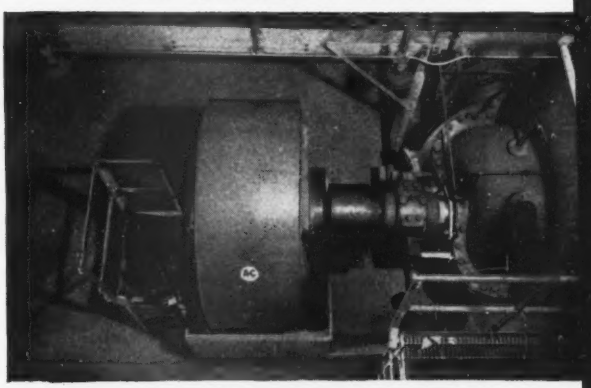
LET'S TAKE A LOOK AT TANNERS CREEK

One thing you're sure to notice at the Tanners Creek plant is that all the major auxiliaries for generating unit No. 2 are driven by Allis-Chalmers motors. Pictured here are a few of the larger ratings in this modern power plant of Indiana & Michigan Electric Company, a part of the American Gas and Electric system.

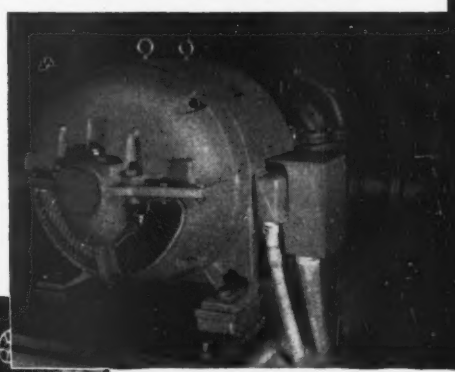
It's worthy of note that A-C is also building the motors for generating unit No. 3, scheduled for operation in 1954.

Allis-Chalmers builds a complete line of integral horsepower motors for power plant service, and your A-C representative can help you select the motors you need.

A-4084



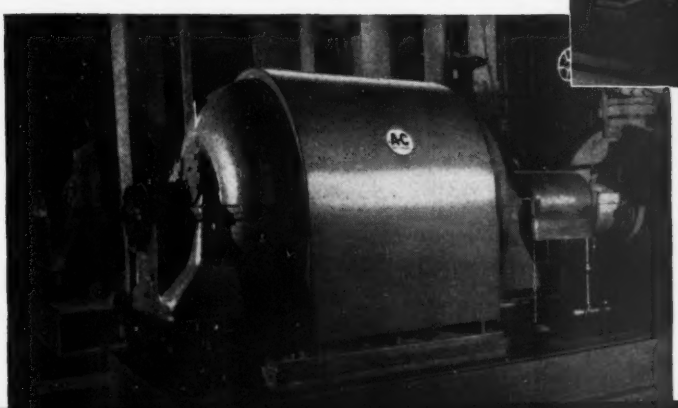
One of two 300-hp, 2300-volt, 218-rpm, drip-proof squirrel-cage motors driving circulating water pumps.



Rated 200 hp, 2300 volts, 1760 rpm, this drip-proof squirrel-cage motor driving an Allis-Chalmers screen wash pump is typical of the smaller ratings.

ALLIS-CHALMERS

Milwaukee 1, Wisconsin



These dependable boiler-feed pump motors are rated 2000 hp, 2300 volts, 3580 rpm each.

Latest advance in Westinghouse Capacitor design

One capacitor for both high and low-temperature applications

The new Westinghouse Inerteen® capacitor now entirely eliminates the need to select capacitors for two extremes of climate.

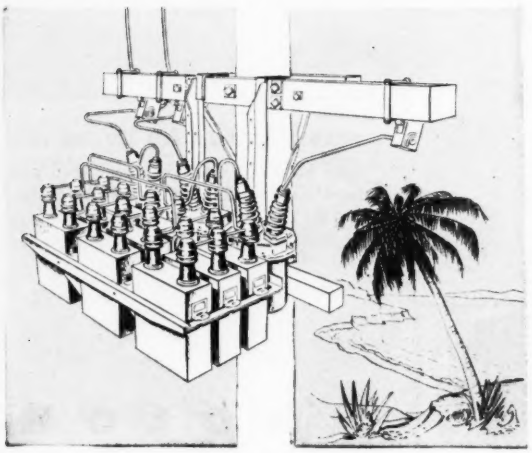
Extensive laboratory testing and over three years of actual field experience have proved the ability of this new capacitor to withstand energizing at temperatures as low as minus 40° F —a decrease in temperature limit of 25° F over previous standard units.

Investigations in the opposite direction have gone up higher than the industry standard of 104° F (average ambient) without excessive losses, corona, aging or any type of permanent change in operating efficiency.

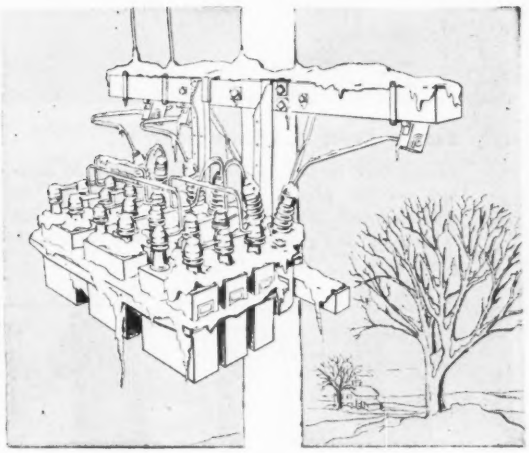
This outstanding capacitor advance has been made possible by coordinated Westinghouse unit design features, *PLUS—an important change in the molecular structure of the dielectric fluid, Inerteen.* Solder-sealed bushings and zinc spray finish, pioneered by Westinghouse, which have established an excellent field record, further insure trouble-free operation under all weather conditions.

For application under all climatic conditions, you will find that the new Westinghouse Inerteen capacitor meets every requirement. Call your Westinghouse representative today for more information, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60852

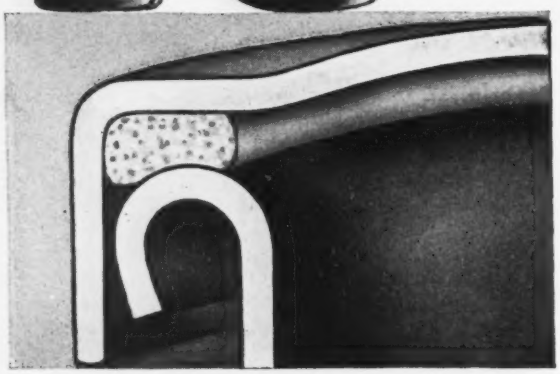
YOU CAN BE SURE...IF IT'S Westinghouse

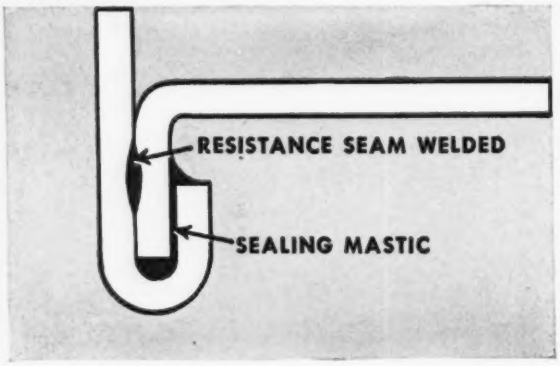


Extreme Heat—laboratory and field tests, with temperatures in excess of industry standards, have been made demonstrating *low losses* and no change in the efficiency of this new capacitor.



Extreme Cold—as low as minus 40° F has presented no problem in energizing this capacitor for switched applications such as the Autotrol* unit shown. *Trade-Mark



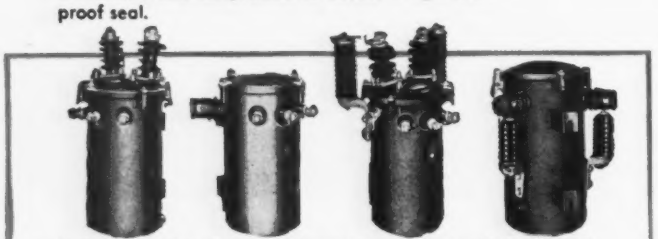


SEALED TANK CONSTRUCTION

Sealed tank construction prevents entrance of moisture and air, greatly increasing the life of the oil and insulation. Illustration shows how cover gasket is retained and compressed to obtain a tight leak-proof seal.

WELDED AND ROLLED LIP ON TANK BASE

Tank base is pressed into tank shell and resistance seam welded. Sealing mastic compound is applied and the extending portion of the tank base is rolled in to provide triple protection against mechanical abuse.



Moloney HiperCore Distribution Transformers are available in all standard ratings from 3 Kva up in both Conventional and CSP designs.

MOLONEY

Manufacturers of Power Transformers
Ratio Control Transformers • Step

FACTORIES AT ST. LOUIS 20, MISSOURI AND TORONTO,

TOUGH!

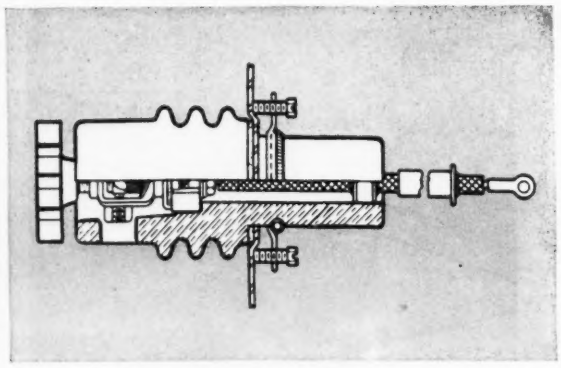
HiperCore DISTRIBUTION TRANSFORMERS

The turtle's tough shell has many qualities in common with Moloney HiperCore Transformer Tanks. Just as the turtle enjoys the reputation for toughness and long life, so does HiperCore. Both can take plenty of punishment . . . for many years.

Check the points of greatest wear and see how Moloney offers greater protection. Rust-resistant, copper-bearing steel HiperCore Tanks are resistance welded to form a leak proof seam. Triple-sealed base positively prevents leakage and the entrance of moisture. Tanks are generously coated with alkyd melamine paint which literally shrugs off extreme weather . . . resists scratches and scuffing.

Inside that tough, rugged tank is a better transformer with the compact design and high performance which only HiperCore construction can provide. For over half a century the name Moloney has meant better engineering . . . better craftsmanship . . . and greater dependability. Check today and you'll make it Moloney all along the line.

MES3-34



HIGH VOLTAGE SIDEWALL BUSHING

Combination protective cap and tightening knob is suitable for working "hot" and is molded high impact resistant phenolic—cold rubber. Connector is high tensile silicon bronze and offers maximum resistance to electrolytic corrosion.

TANK FINISH

Tanks are spray-painted, after thorough sand blasting, with an alkyd melamine paint especially developed for Moloney Transformers. Each coat of paint is baked on. Resultant protective surface is durable, highly resistant to chipping, scuffing, and severe weather conditions.

E L E C T R I C C O .

Distribution Transformers • Load Voltage Regulators • Unit Substations

MOLONEY ELECTRIC = { BETTER PERFORMANCE / GREATER RELIABILITY / LESS MAINTENANCE

ONTARIO, CANADA • SALES OFFICES IN ALL PRINCIPAL CITIES

Penta-treated poles do not bleed, won't soil hands and clothing. Because Penta is also virtually odorless, treated crossarms may be stored indoors. Penta gets deep into the cells of the wood . . . will not wash out.

More than 60 treating plants across the country will process wood to your specifications. Penta treatment helps to reduce power loss by preventing the formation of decayed areas that retain high moisture.

Poles go out of the plant *clean*, ready for years in line. For further information, call the Monsanto office near you.

Clean
PENTA
Treatment
Preserves
Poles,
Crossarms

The Philadelphia Electric Company is a long-time user of Penta. Southern pine poles are treated to an 8-pound retention of Penta per cubic foot; fir crossarms to 6 pounds.

IMPORTANT *information for distribution and maintenance engineers is contained in this booklet titled "Penta Protection for Poles and Crossarms." For your copy write Monsanto Chemical Company, Organic Chemicals Division, 800 North Twelfth Blvd., St. Louis 1, Missouri.*

MONSANTO
CHEMICALS – PLASTICS
®

SERVING INDUSTRY... WHICH SERVES MANKIND

RCA MICROWAVE

RADIO-RELAY COMMUNICATION AND REMOTE CONTROL

Over the years RCA MICROWAVE has proved it stays in service when you need communication most.

Most practical system, most complete service

RCA Microwave gives you as many voice channels as you need with minimum use of frequency space. It employs conventional tubes; familiar circuits not difficult to service. It interconnects with your telephone lines and switchboards.

Over the years the operating records of RCA MICROWAVE systems reveal a long history of successful operation through every kind of weather. Numerous RCA installations are now providing continuity of service in many applications.

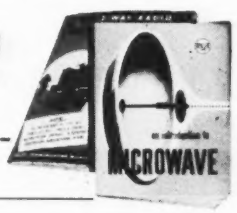
RCA survey, construction and installation facilities are a complete, single-source, single-responsibility service.

For speedy, economical communication and for adequate, remote supervision, contact your local RCA Regional Office for information, or *mail coupon below.*

For dependable mobile communications, use *RCA 2-Way Radio.*

And remember, only RCA can provide the nation-wide service facilities of the RCA Service Company.

RADIO CORPORATION of AMERICA
COMMUNICATIONS EQUIPMENT **CAMDEN, N. J.**



Radio Corporation of America
Communications Division
Dept. 45U, Building 15-1
Camden, N. J.
Please send me your new, free booklet on:

- ☐ RCA Microwave
- ☐ RCA 2-Way Radio

Name_____

Title_____ Company_____

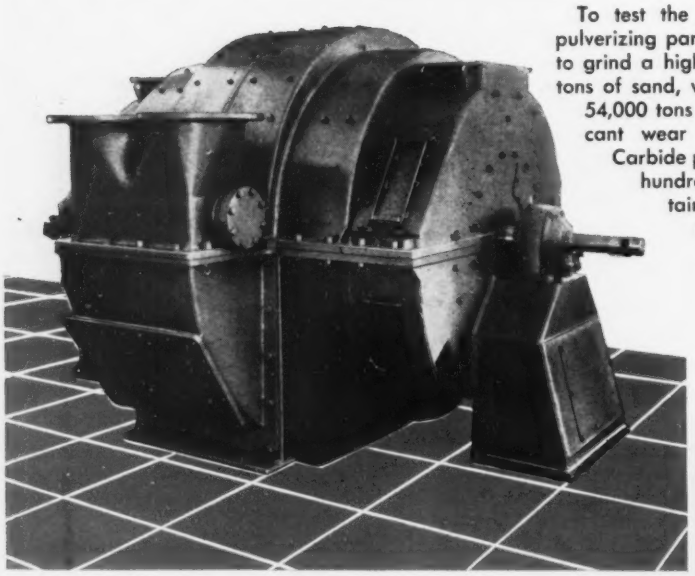
Address_____

City_____ Zone_____ State_____

One Reason for Long Operating Performance and Low Maintenance of

RILEY "50" Pulverizers...

Tungsten Carbide facing on pulverizing parts of Riley "50" Pulverizers has demonstrated phenomenal resistance to abrasion in coal grinding service . . . And no wonder! Tungsten Carbide is the hardest of manufactured materials . . . approaching the hardness of the diamond! It is so tough and wear resistant that it is used in bits for stone drilling and mining. Naturally, then, Tungsten Carbide is the best material for use in coal pulverization.

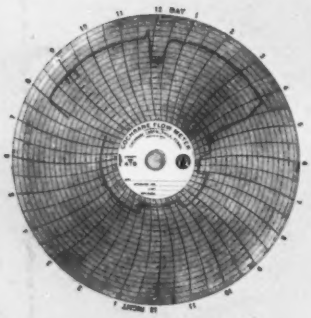


The Riley "50" Duplex Pulverizer

To test the performance of Tungsten Carbide faced pulverizing parts, Riley Engineers set up a Riley Pulverizer to grind a highly abrasive silica sand. After grinding 180 tons of sand, which is the equivalent in abrasive wear to 54,000 tons of coal of an average quality, the insignificant wear which occurred indicated that Tungsten Carbide parts in Riley "50" Pulverizers could pulverize hundreds of thousands of tons of coal with sustained high fineness before requiring replacement. Maintenance records of Riley "50" Pulverizer installations have proved the effectiveness of tungsten carbide in providing long continuous periods of operation with low maintenance costs per ton and sustained fineness.

Here are other ways by which you'll profit from Riley "50" Pulverizers

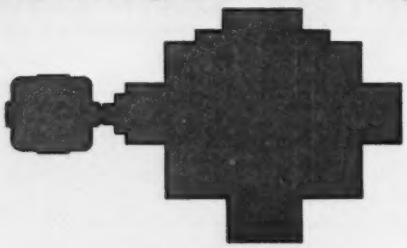
Save Fuel!



Sustained high degree of fineness and complete combustion with Riley burners maintain low carbon losses. Also many Engineers find it hard to believe the wide load ranges and stable ignition possible with Riley Pulverizers. Many Riley installations operate with load ranges of 10 to 1 with perfectly stable operation.

Save Space!

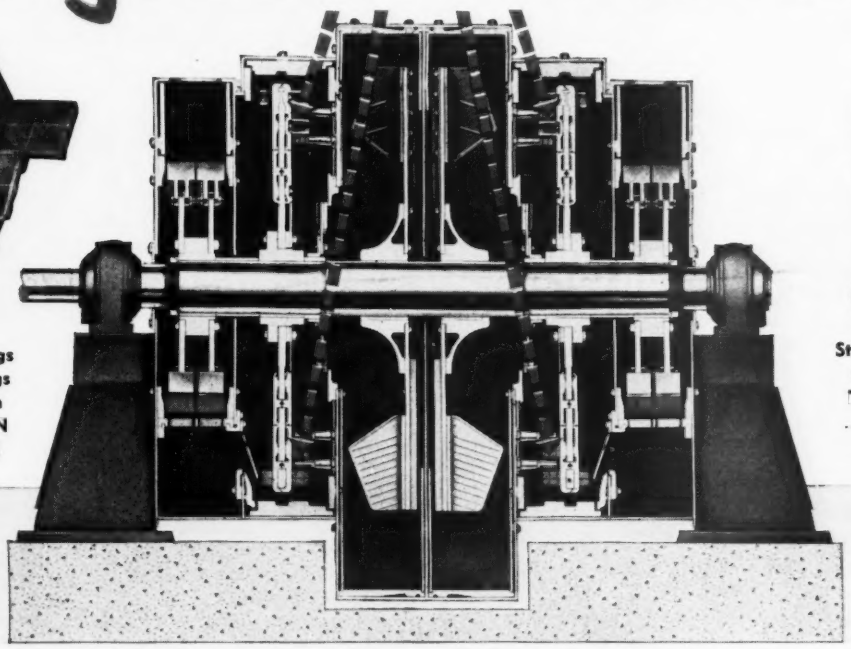
A typical 40,000 lbs/hr. Riley "50" model weighs only 46,000 lbs. and requires a mere 27" deep reinforced concrete foundation. Complete with motor it occupies a space only 18' 6" long x 10' 8" wide x 7' 0" high.



Be sure to ask your Riley Representative to point out the

tungsten carbide!

Moving Pegs are forgings faced with TUNGSTEN CARBIDE



Stationary Peg faced with TUNGSTEN CARBIDE

TRADE MARK Rx REGISTERED

RILEY

STOKER CORPORATION

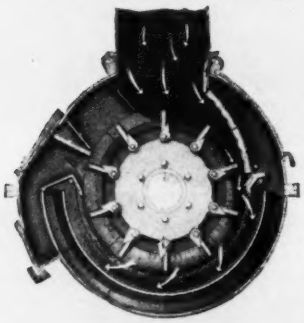
WORCESTER, MASS.

Boston, New York, Philadelphia, Buffalo, Washington, Pittsburgh, Cleveland, Detroit, Chicago, Cincinnati, Charlotte, New Orleans, Atlanta, St. Louis, Kansas City, St. Paul, Tulsa, Houston, Denver, Salt Lake City, Los Angeles, Portland, Seattle

COMPLETE STEAM GENERATING UNITS

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • ECONOMIZERS
WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

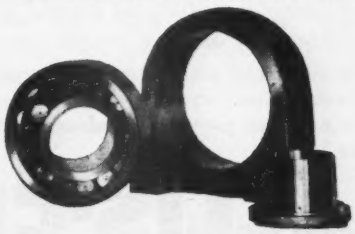
Save On Capital Investment!



There is no need to install an oversized mill to take care of coals of high moisture. New Crusher Dryer section is designed with ample capacity for coals of highest moisture content. Surface moisture of coal is evaporated in this section before entering main pulverizer. There is no capacity reduction with increase in moisture. In addition, foreign materials and tramp iron are rejected, thereby, reducing maintenance and preventing damage to pulverizing parts.

Quiet Operation!

Heavy duty railway type bearings and absence of metal to metal contact insures quiet, vibrationless operation. Even when coal feed is shut off the "50" Pulverizer operates quietly, without wear of parts.



many operating advantages of the new Riley "50" Pulverizer.

The RIGHT DRAFT for Any Combustion Condition

...Stepless, Wide Range Speed Control of Direct Coupled Draft Fans

When Type 257 Liquid Rheostats control the speed of boiler fans driven by wound rotor motors you get:

- **Immediate response to varying draft conditions.**
- **Smooth, continuous, *stepless* speed control.**
- **Equal sensitivity over the entire operating range.**

HOW IT WORKS. Motor speed is varied by increasing and decreasing resistance. This is accomplished by raising and lowering electrodes and the level of current-carrying electrolyte. A pilot device transmits draft condition to a lifting mechanism which controls electrode position and electrolyte level. A full resistance range is provided in only 10 inches of electrode travel. The basic principle of liquid rheostat operation plus the utilization of specially engineered electrodes gives a linear relationship between motor speed and electrode travel over the complete rheostat range.

Since the rheostat is not mechanically connected to the motor it may be located to suit the most convenient plant layout. For complete details, contact your Allis-Chalmers representative or write for leaflet 14S7544. A-4066

ALLIS-CHALMERS

Milwaukee 1, Wisconsin

the Motor Speed Control

that Cuts Lathe Time and Improves Quality

Facing off a 4½" diameter dial where very smooth finish is required. The Type 1702-A Variac Motor Speed Control enables the operator to slow lathe speed as larger diameter is worked. Maintaining cutting-feet-per-second constant avoids chatter.

Variac MOTOR SPEED CONTROLS are COMPLETE units for operating DC Motors from AC Lines, and feature:

- ★ Low Speed
- ★ Selenium Rectifiers for Ruggedness
- ★ Good Regulation
- ★ No Pulsating At Low Speeds
- ★ Easy Installation and Maintenance
- ★ Wide Speed Range
- ★ High Starting Torque
- ★ Rapid Starting and Stopping
- ★ Dynamic Braking

If you need a speed control which will increase the everyday versatility of your lathe and enable you to meet the most stringent production requirements . . . the Variac Motor Speed Control is the answer. This smoothly operating control makes lathe work much more efficient. In production, it enables quality work to be turned out rapidly and reliably. Variac controls are available in three sizes for 1/15th to ¾ hp motors.

LATHE OPERATORS who use these Controls REPORT THESE TIME-SAVING FEATURES:

★ *Variac Speed Controls eliminate need for changing step pulleys or gears — twist of a knob gives any speed from 5 or 10 rpm to rated*

★ *Instant Starting — no waiting for gears to mesh or engage as in mechanical controls — rapid reversing where needed*

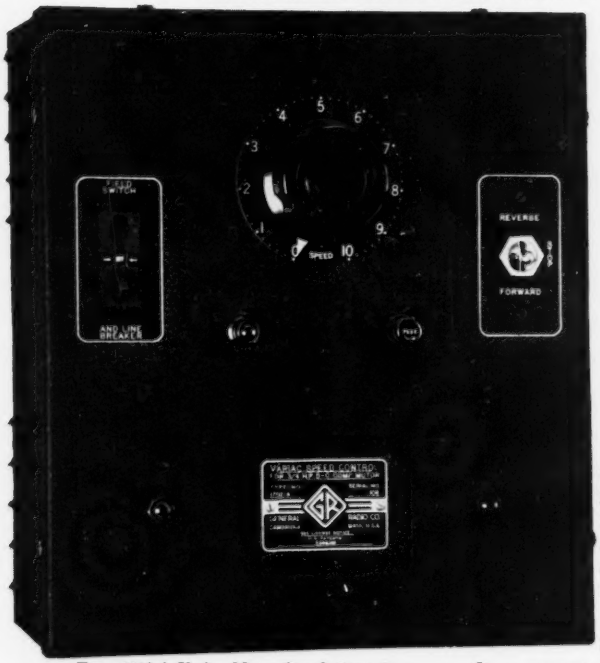
★ *Instantaneous Braking Saves Production Time — permits sudden stops, eliminating tool overruns when under power feed or when cutting screw threads*

★ *Infinite Selection of Speeds — machine is slowed or speeded for optimum operation by flick of the wrist — in turning or facing operations, speed can be varied continuously as diameter of stock changes*

★ *Power at Few RPM — considerably more power at slow speeds makes this control invaluable in reaming and many other applications*

★ *Less Wear and Tear On Tools — speed can be set to suit material being worked or tool being used*

★ *Tapping in Slow Motion — with Variac Speed Control, lathe can be run at few rpm while tap is slowly run into drilled piece — eliminates necessity for measuring depth of drill hole on tap and carefully watching distance to which tap is advanced — motor stalling when tap is all the way in prevents tap breaking or spoiling of threads*



Type 1702-A Variac Motor Speed Control — plugs into regular 115v a-c power lines — provides continuous control of ½ and ¾ hp d-c motors — unit is completely self-contained — price $230, less motor

Variac Motor Speed Controls are amazingly efficient devices for the control of everyday machine operations including precision drilling — grinding — toroidal wire winding and screw cutting. They are time tested, highly recommended tools widely used in machine shops and large-scale factory production departments throughout the country.

GENERAL RADIO Company

275 Massachusetts Avenue, Cambridge 39, Massachusetts, U. S. A.

90 West St. NEW YORK 6 · 920 S. Michigan Ave. CHICAGO 5 · 1000 N. Seward St. LOS ANGELES 38

SEND IN COUPON FOR MORE INFORMATION

General Radio Company, 275 Massachusetts Ave., Cambridge 39, Mass.

Please send me a copy of the VARIAC Motor Speed Control Bulletin:

Name_____
(580)

Company Name_____

Street_____

City_____ Zone_____ State_____

ARE YOU PAYING FOR THE MISSING 5 INCHES?

ARE YOU paying $.02705 for approximately *7 inches* of copper weatherproof wire when you could get a *full foot* of Kaiser Aluminum weatherproof wire *for the same money?*

If you are... you're spending about $19.22 too much per 1000 feet!*

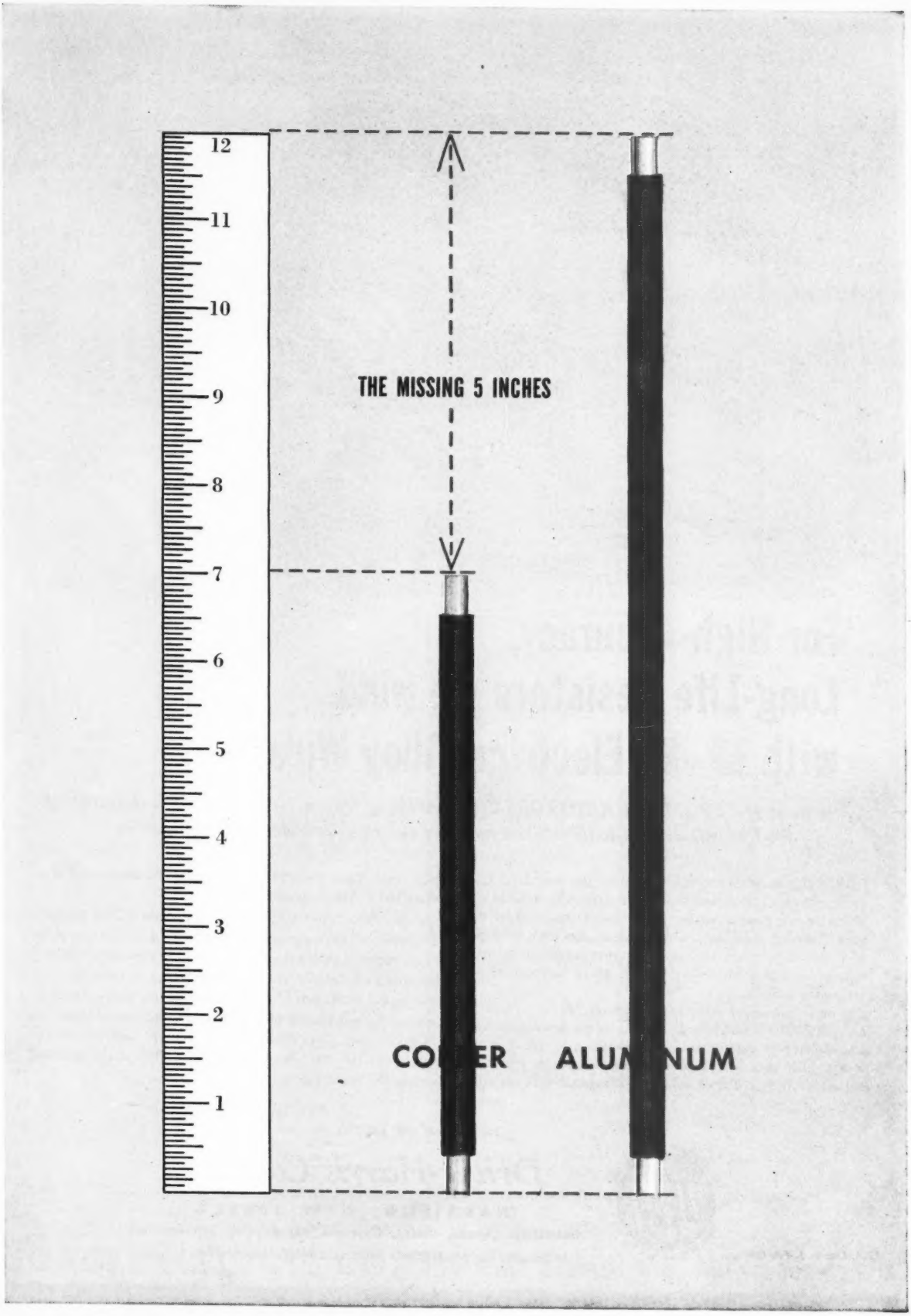
All types of Kaiser Aluminum weatherproof wire give you big savings over copper wire of equivalent current-carrying capacity.

Why not call or write us, or one of our distributors, for complete information? Kaiser Aluminum & Chemical Sales, Inc., Oakland 12, Calif.

*Based on August, 1953 prices for #6 Copper TBWP and #4 Solid Aluminum, Neoprene or Polyethylene covered.

Kaiser Aluminum

setting the pace—in growth, quality and service.


12
11
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THE MISSING 5 INCHES
ALUMINUM

"For High-Accuracy, Long-Life Resistors we wind with D-H Electrical Alloy Wire"

...so states INSTRUMENT RESISTORS COMPANY, of Union, New Jersey, manufacturers of IN-RES-CO quality-built resistors for every electrical and electronic application

IN-RES-CO resistors are wound to meet the most critical requirements without excessive cost; standard inductive and non-inductive units are available in resistance ranges from 0.01 ohm to several megohms—with power ratings from a fraction of a watt to 10 watts. Included, are types especially suited to counter excessive humidity, fungus, space limitations, and temperature rise.

Says Instrument Resistors Company: "For 23 years, we have devoted our facilities exclusively to the development and manufacture of quality resistance components. The fact that today, with such a wealth of experience to our credit, we specify Nichrome, Karma, and D-H Manganin wire for windings, constitutes the strongest endorsement we can offer of these Driver-Harris products."

Nichrome*, Karma*, and D-H Manganin deliver top-level performance—their characteristic electrical and physical properties remaining unchanged even under exceptionally exacting operating conditions. They are ready to go to work for *you*, too—as are more than 80 other Driver-Harris alloys. Profit by consulting with us. We shall be glad to make recommendations based on your particular needs . . . and are confident we can meet your resistance requirements with D-H alloys that will assure the best possible results.

Nichrome and KARMA are produced only by

Driver-Harris Company

HARRISON, NEW JERSEY

BRANCHES: Chicago, Detroit, Cleveland, Los Angeles, San Francisco

In Canada: The B. GREENING WIRE COMPANY, Ltd., Hamilton, Ontario.

*T.M. Reg. U. S. Pat. Off.

MAKERS OF THE MOST COMPLETE LINE OF ELECTRIC HEATING, RESISTANCE, AND ELECTRONIC ALLOYS IN THE WORLD

SORGEL AIR-COOLED Dry-Type TRANSFORMERS

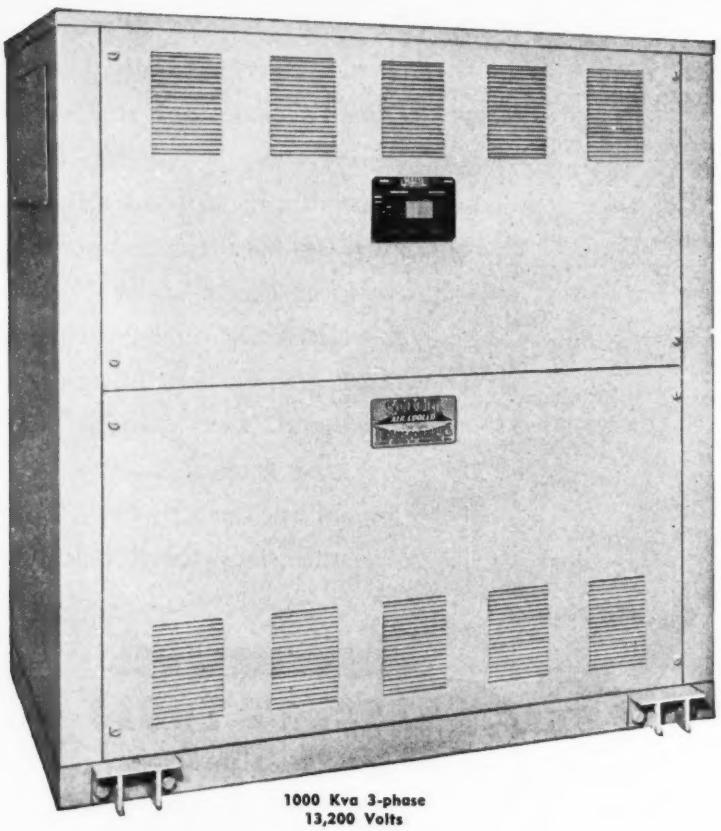
Accepted Quality

Complete Line

¼ to 1500 Kva single phase. 1 Kva to 3000 Kva 3-phase, 2-phase and phase changing. All voltages, 120 up to 15,000 volts.

Also Substations, Special Transformers, Reactors

Accepted by Engineers, Contractors, U. S. Government, as Time-Tested and Top Quality



1000 Kva 3-phase
13,200 Volts

¼ Kva
single phase
480/240 to
240/120 volts

100 Kva single phase

Sales Engineers in Principal Cities

SORGEL ELECTRIC CO., 834 West National Ave., Milwaukee 4, Wis.

Pioneers in the development and manufacturing of Air-Cooled Dry-type Transformers — Over 35 years

TWO NEW CRESCENT SCREWDRIVERS FEATURE TENITE HANDLES

K1300 and K1500 series

K1700 series

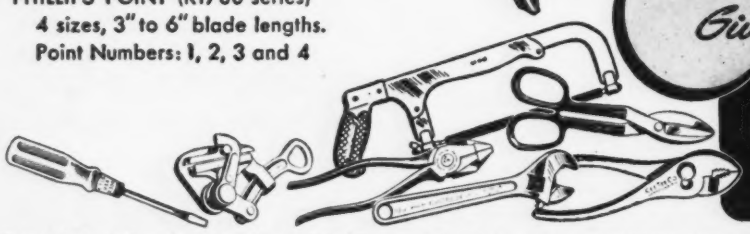
● Here's typical Crescent quality in a new line of plastic handled screwdrivers! Blades are hot forged and hardened full length. Then blade and handle are assembled under pressure so blade will never loosen. Finally, each screwdriver is individually tested to insure blade tips that will not break or twist.

You'll recognize these new Crescent Screwdrivers by their distinctive blue-colored Tenite handles, with soft-edged knurling that assures a sure grip without blistering the hand. Two patterns for slotted screws . . . one for Phillips head screws . . . in the sizes listed below.

STANDARD PATTERN (K1300 series)
5 sizes, 3" to 10" blade lengths.

CABINET PATTERN (K1500 series)
4 sizes, 3½" to 8½" blade lengths.

PHILLIPS POINT (K1700 series)
4 sizes, 3" to 6" blade lengths.
Point Numbers: 1, 2, 3 and 4



CRESCENT TOOLS
Give Wings to Work
®
Sign of the Artisan
Symbol of Excellence

Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK

OVER THE HIGH VOLTAGE HORIZON!

R & I E RESEARCH and DEVELOPMENT

Looking out for your future—over the present high voltage horizon. That is the program of R&IE Research and Development. Here, we are determining factors associated with 500 Kv designs: —adequate and economical insulation, proper break distance, effective corona shielding, safe, dependable, all-weather operation and general refinement of details.

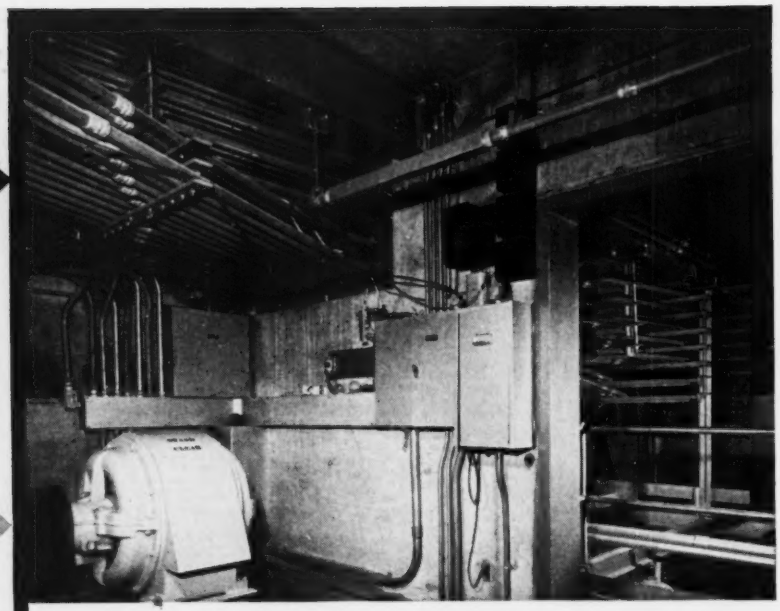
When your system operation indicates voltage levels beyond 230 Kv, and even beyond 330 Kv, these data and our engineers are available for assistance in your planning. Send us your problem.

R&IE SWITCHING EQUIPMENT
DIVISION OF I-T-E CIRCUIT BREAKER CO., GREENSBURG, PA.

One of the many development tests on the Type TTR49

what a difference

what a saving



...with COPE CABLE TROUGH

SEEING IS BELIEVING! Here you can see at a glance the time, material and labor savings possible on cable installations through the use of Cope Cable Trough. Both of these photographs were taken at the City of Glendale (California) generating plant. The upper and older installation shows 126 - 1¼" conduits containing cables for controlling the auxiliaries for two turbine generators. Just look at the tremendous number of bends and fittings, and the complicated hanger construction needed to support this maze of conduit. You can imagine the high cost of engineering, material, and installation this entailed, even before the big job of pulling cable through the conduits was possible.

Now examine the lower, recent installation (view taken during construction) involving control of two additional generators, where cables for control conduits 480 volt auxiliary power, and 2400 volt auxiliary power are carried in Cope Cable Trough. It was a simple job to lay out and erect this trough using standard lengths and fittings. Costs were but a fraction of the older method; time and material were saved and accessibility for visual cable inspection is provided. Additional cables may be added with great ease.

You, too, can make such savings.

T.J. Cope INC.

A detailed bulletin giving all the facts about Cope Cable Trough will be sent upon request. Write for it.

You know Cope by these products

711 SOUTH 50th ST. • PHILADELPHIA 43 • PA.

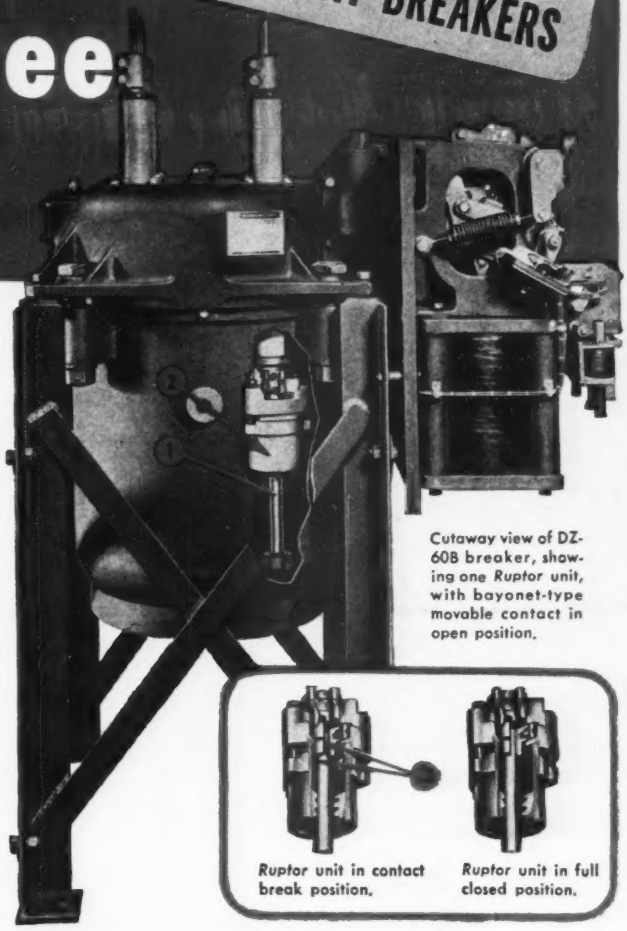
DIVISION OF I-T-E CIRCUIT BREAKER CO., GREENSBURG, PA.

on the
Type TTR49

Three Reasons Why

...Years of Trouble-Free Service

ALLIS-CHALMERS
Indoor
OIL CIRCUIT BREAKERS



Cutaway view of DZ-608 breaker, showing one *Ruptor* unit, with bayonet-type movable contact in open position.

Ruptor unit in contact break position.

Ruptor unit in full closed position.

One Few moving parts!

Bayonet contacts (1) are the only moving parts of the *Ruptor* interrupting device.

Two Easy inspection!

Drop the tank, and the bayonet contacts are visible in open position. For access to the stationary contacts, one needs only to remove four bolts and cylindrical shell (2).

Three Self-aligning and Self-cleaning contacts!

Tulip and bayonet contacts (3) maintain high conductivity without readjustment or cleaning. Arc energy is minimized by efficient interruption within oil-filled *Ruptor* unit. This in turn contributes to long contact life and low oil deterioration.

In addition, a mechanically trip-free solenoid operating mechanism controls contacts of time-proved *Ruptor* interrupting devices. And pole unit mechanism is self-lubricated — completely enclosed — sealed from dust, dirt, corrosion.

In brief, Allis-Chalmers DZ breakers are built to assure years of dependable, trouble-free service.

Allis-Chalmers power circuit breakers are available in ratings from 2.5 to 230 kv, with interrupting capacities from 15,000 to 10,000,000 kva, to meet all industrial and power company requirements. For more information, call your nearby A-C representative, or write to Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4057

Ruptor is an Allis-Chalmers trademark.

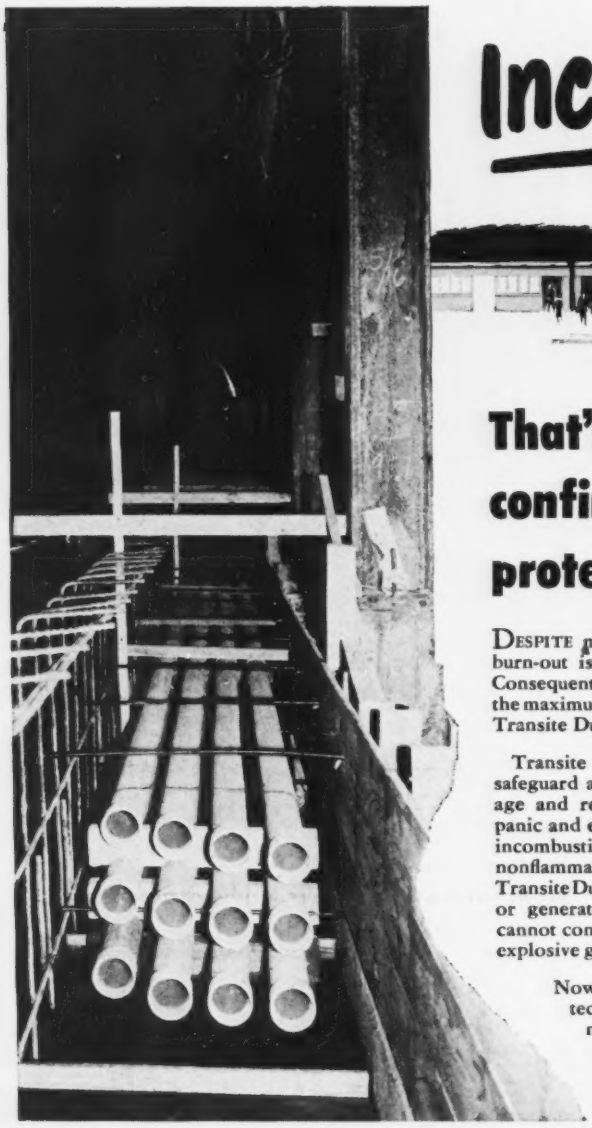
TYPE	RATED KV	MINIMUM KV AT RATED KVA	RATED AMPS	KVA INT. CAPACITY
DZ-40B*	7.2	2.3	600	100,000
			1200	100,000
			2000	100,000
DZ-60B†	13.8	4.0	600	150,000
			1200	150,000
DZ-100B†	13.8	4.0	1200	250,000
DZ-200B†	13.8	6.6	1200	500,000
			2000	500,000

*Ask for Bulletin 71B6179. †Ask for Bulletin 71B6129.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

Incombustible...



That's why TRANSITE® DUCTS confine burn-outs and protect adjacent cables

DESPITE modern precautions, the burn-out is still a potential hazard. Consequently, cables should be given the maximum fireproof protection that Transite Ducts provide.

Transite Ducts confine burn-outs, safeguard adjacent cables from damage and reduce the possibilities of panic and explosion because they are incombustible throughout. Made of nonflammable asbestos and cement, Transite Ducts will not burn, smoulder or generate smoke or fumes. They cannot contribute to the formation of explosive gases.

Nowhere is the fireproof protection of Transite Ducts so necessary as in such vital locations as subways, tunnels and power plants.

As the panel below shows, incombustibility is only one of the advantages of Transite Ducts. For more information, write Johns-Manville, Box 60, New York 16, N. Y.

4 OTHER REASONS WHY TRANSITE DUCTS DO A BETTER JOB AT LESS COST:

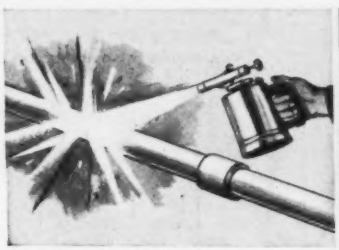
1. Corrosion-Resistant. Transite, being made of inorganic asbestos and cement, resists corrosion and is immune to electrolysis.

2. Permanently Smooth Bore. Transite makes long cable pulls easy. Danger of damage to cables is also minimized.

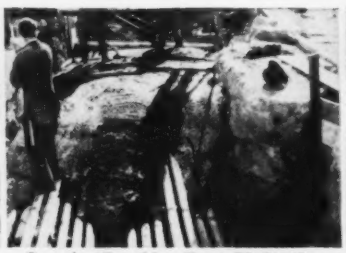
3. Easy To Install. Transite Ducts are light weight, easy to handle. Joints are quickly made. And long 10-ft. lengths reduce the number of joints in line.

4. High Thermal Conductivity. Cables run cooler in Transite, reducing I^2R losses, increasing current capacity and prolonging insulation life.

In Subways, where passenger safety is paramount, fireproof Transite Ducts will, in the event of a burn-out, confine it and reduce the hazard of panic.



Transite Does Not Burn, smoke or fume because its ingredients, asbestos and cement, will not support combustion. It cannot contribute to the formation of explosive gases.



Transite Provides Heat Dissipation, Too. In addition to providing fireproof construction, Transite Ducts permit cables to run cooler, reducing I^2R losses.

Photograph courtesy of Triborough Bridge and Tunnel.

In Vehicular Tunnels, if a burn-out should occur, Transite Ducts limit damage, permit speedier repair and an earlier re-opening for traffic.

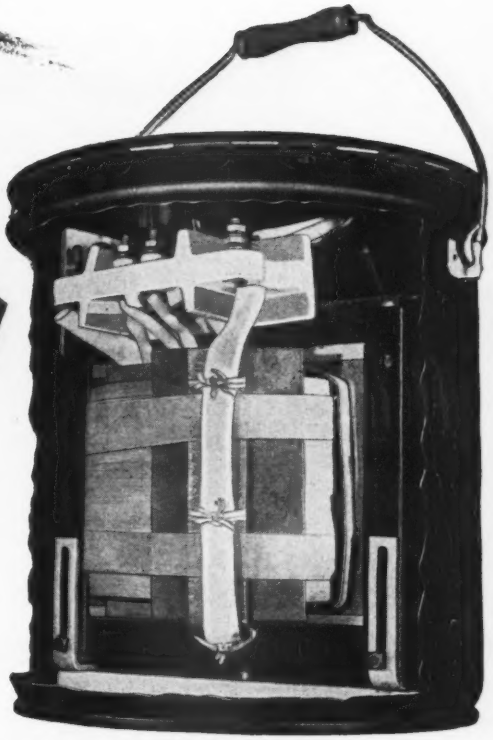
JOHNS-MANVILLE JM PRODUCTS

Johns-Manville TRANSITE DUCTS

TRANSITE KORDUCT—for installation in concrete

TRANSITE CONDUIT—for exposed work and installation underground without a concrete encasement

Quick repair for burned-out transformers



Wagner Replacement Core and Coil Assemblies come to you *Ready to Install*
—without testing or drying—packaged in transformer oil for complete protection

Wagner has the answer to the problem of renewing or up-rating old or burned out transformers. Specify the packaged Form W core and coil assembly . . . a brand new element, exactly like those used in new Wagner Transformers.

These replacement elements come ready for use—fully dried and tested—protected in a sealed container filled with Wagner 7-NI inhibited transformer oil, which you may also use in your tank. Available in ratings from 3 through 167 kva.

Installation is easy . . . the assemblies are complete with terminal board or tap changer, with leads ready to install in your tank. Each assembly has a new serial number and name plate.

Wagner Bushing Assemblies

High Voltage Bushing Assembly

Available in cover-mounted or tank wall mounted types to meet a wide range of requirements. Gasket, solderless connector-type terminal and clamping devices are included—fuses can be furnished when specified.

Low Voltage Bushing Assembly

Ready to install—includes porcelain bushing, gasket, solderless connector-type terminal and clamping device.

Field Repair Service for Substation Transformers

Wagner's Transformer Service Trucks—completely equipped for field repairs—each with the services of an expert—are available on schedule in most localities. The cost of this exclusive Wagner service is nominal—write for information.

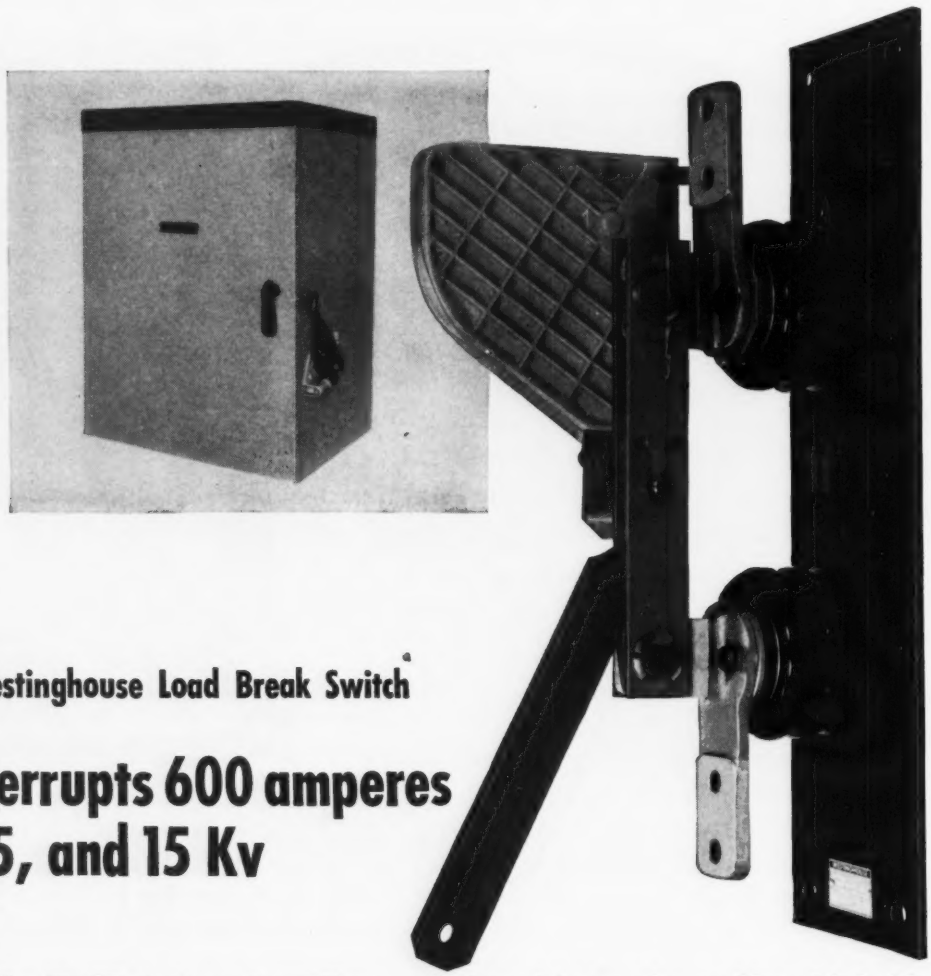
WAGNER ELECTRIC CORPORATION
6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

® Wagner Electric Corporation EST. WE 1891

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

TS 53-1



Improved Westinghouse Load Break Switch

Now interrupts 600 amperes at 5, 7.5, and 15 Kv

More interrupting ability—The Westinghouse line of Type LCB indoor interrupter switches has been redesigned to boost the interrupting ratings. The new design raises the rating to 600 amperes at 5, 7.5 and 15 kv. This rating applies when the switch is used as a NEMA Class B device guaranteed to operate 100 times without maintenance or repair of any kind. As a NEMA Class A device guaranteed for 500 operations, the switch will interrupt 600 amperes at 5 kv or less, 200 amperes at 7.5 kv and 100 amperes at 15 kv.

Uses De-ion® arc-quenching principle—The load-interrupting ability of the Westinghouse Type LCB switches is provided by the De-ion action. When the switch is closed, practically all of the current flows through a main blade. As the contact on the main blade starts to open, current is transferred momentarily to a quick-break blade which is inside an arc chute. When the quick-break blade is snapped open at high speed, the heat of the arc releases a blast of de-ionizing gas from the gas-generating lining of the arc chamber. This combination of quick-break and De-ion action quickly extinguishes the arc and the complete circuit is safely disconnected.

Self-cleaning contact surfaces—The contact area on each switch blade has several fine parallel ridges or teeth of solid silver. When the switch is closed, these knife-edge teeth bite into the opposite jaw block and form a highly efficient electrical contact. Opening and closing the switch forces any dirt that may occur into the spaces between the teeth, keeping the contact surfaces clean and eliminating maintenance.

Several ratings—Type LCB switches are available in several ratings from 2.5 to 23 kv, open or enclosed, single or double-throw. For more information, write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania, for a copy of Descriptive Bulletin 36-117. J-60851

YOU CAN BE SURE... IF IT'S

Westinghouse

130° C.

WITH IMPROVED

BH "649"

Laboratory tested for retention of flexibility and original rated electrical protection after

130 C° — 1500 hours
150 C° — 500 hours
160 C° — 24 hours
232 C° — 3 hours

BH "649" is a braided Fiberglas sleeving coated with an improved vinyl-chloride formulation. Available in all standard sizes and colors, in grades A-1 (7000 V.), B-1 (4000 V.) and C-1 (1500 V.). Send for data sheets and samples from current production.

Another Bentley, Harris First!

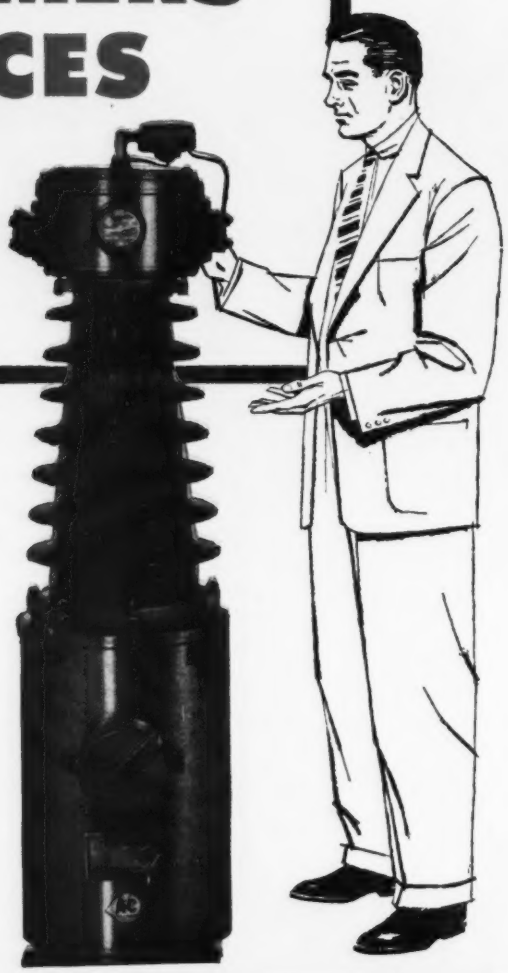
Bentley, Harris Manufacturing Co.
Conshohocken, Pa.
Address Dept. W-9

BH Fiberglas* SLEEVINGS

*BH Non-Fraying Fiberglas Sleevings are made by an exclusive Bentley, Harris process (U. S. Pat. No. 2393530). "Fiberglas" is Reg. TM of Owens-Corning Fiberglas Corp.

ALLIS-CHALMERS INTRODUCES

New Line of Outdoor Current Transformers



Featuring:

- ★ **Weight Reductions Up to 54% Compared With Previous Designs**
- ★ **High Thermal Rating**
- ★ **Increased Mechanical Strength**
- ★ **Corona-Free Design for Long Insulation Life**

HERE IS A COMPLETELY NEW LINE of current transformers for outdoor use on power circuits 69 kv and below. They bring you many advances, including design features that result in excellent performance, high thermal and mechanical strength, improved insulation life, and mechanical advantages that simplify installation.

Most important, their ruggedness has been proved by exhaustive tests. Temperature rise at normal current is low, allowing ample overcurrent in emergencies. The transformers are rated 65 times normal primary current under short circuit conditions.

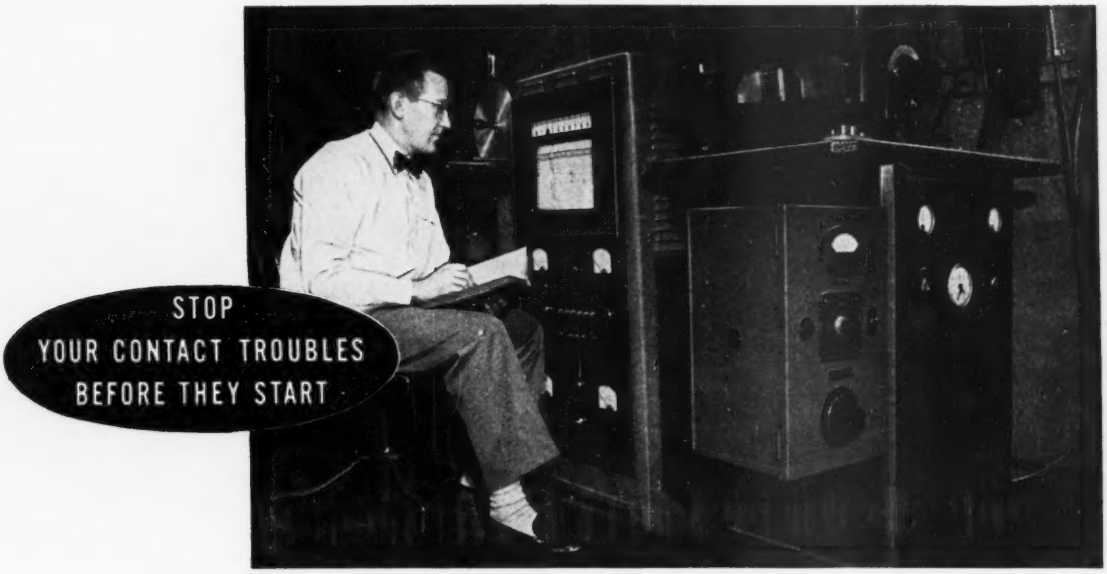
For the complete story get your copy of the paper "Progress in Instrument Transformer Design" by writing Allis-Chalmers, Milwaukee 1, Wisconsin. A-4109

LESS WEIGHT – LESS FLOOR SPACE
Compare New Type SCW with Previous Design

Kv	Design	Height	Floor Space	Gal. Oil	Weight (lbs.)
25	New Type SCW	42"	14" x 19"	9	230
	Previous Type	33"	22" x 22"	15	490
34.5	New Type SCW	45"	14" x 19"	9½	230
	Previous Type	33"	22" x 22"	15	490
46	New Type SCW	55"	16" x 23"	16	475
	Previous Type	40½"	23" x 23"	18½	500
69	New Type SCW	61"	16" x 23"	18	525
	Previous Type	46½"	28½" x 28½"	35	1000

A-C ALLIS-CHALMERS

ALLIS-CHALMERS



X-ray diffraction equipment in the Mallory Contact Engineering Laboratory. It is so sensitive it will identify contaminating films of less than a hundredth of a micron.

Less Than a Hundredth of a Micron!

The slightest trace of contaminating films on contact surfaces can be identified by X-ray diffraction equipment.

In a contact, trouble can be a lot of things. The paper used in packaging, the type of glue on sealing tape, insulation on a wire, atmospheric conditions . . . are just a few of the many things that can deposit a contaminating film on contact surfaces.

Because we have the equipment to identify contaminating films, we can track trouble to the source and correct it. This same X-ray diffraction equipment is also used in the development of new contact materials, by identifying unforeseen formations that may develop during production processes. It is used in life test work to study gradual changes taking place.

This is but one example of the complete facilities that are ready to go to work on your contact problems . . . whether it is a simple button contact or complex contact assembly that is involved. If you would like to improve the contacts in your products or produce them at lower cost, get in touch with us at your first opportunity. Our engineers will be glad to talk to you . . . answer your questions.

Expect more . . . Get more from **MALLORY**

In Canada, made and sold by Johnson Matthey and Mallory, Ltd., 110 Industry Street, Toronto 15, Ontario

Electrical Contacts and Contact Assemblies

P.R. MALLORY & CO. Inc.
MALLORY

SERVING INDUSTRY WITH THESE PRODUCTS:
Electromechanical—Resistors • Switches • Television Tuners • Vibrators
Electrochemical—Capacitors • Rectifiers • Mercury Batteries
Metallurgical—Contacts • Special Metals and Ceramics • Welding Materials

P. R. MALLORY & CO. INC., INDIANAPOLIS 6, INDIANA

CAPACITOR
MOUNT IN ANY POSITION
Complete air evacuation assures high dielectric strength
Handy lifting hook can be used to hoist G-E capacitors without danger to seal. Installation is easier, faster and safer.

GENERAL ELECTRIC CAPACITORS CAN BE LIFTED BY THE BUSHINGS

Cast-glass bushings are welded and soldered directly to the case for permanent hermetic seal

You can forget installation problems with General Electric Pyranol* capacitors . . . they're easy to install. Just lift the capacitor by the glass bushings—there's no danger to the unit.

EXCLUSIVE WELDED GLASS BUSHINGS, on 15 and 25-kvar units, 2400 to 7960 volts, have non-corrodible nickel alloy flange cast directly in the glass. The flange is welded directly to the case for strength and then soldered by induction heating for permanent airtight seal. Glass bushings provide liberal creepage distance and flashover strength with freedom from flashover troubles even under severe atmospheric conditions.

CLAMP-TYPE TERMINALS permit easy, solderless connections—speeding installation. One-piece neoprene insulating caps can easily be slipped over the terminals after connections are made to prevent shorting by birds or animals.

*Registered trade-mark of General Electric Company

Remember, whether you need to increase kw capacity of feeders, transformers, regulators, or the entire system back to the generators . . . whether you want to improve feeder voltage levels . . . reduce overall losses . . . or defer the expense of major changes in feeder layout, General Electric Pyranol capacitors are the practical low-cost solution.

Capacitors are the only items of major electrical equipment that cost less today than in 1940. No other electrical investment does so much for so little.

Why not investigate the values of G-E Pyranol capacitors today? Contact your G-E Apparatus Sales Representative, or write General Electric Company, Section 441-6, Schenectady 5, New York.

1876 75 1951 YEARS OF ELECTRICAL PROGRESS

Progress is our most important product

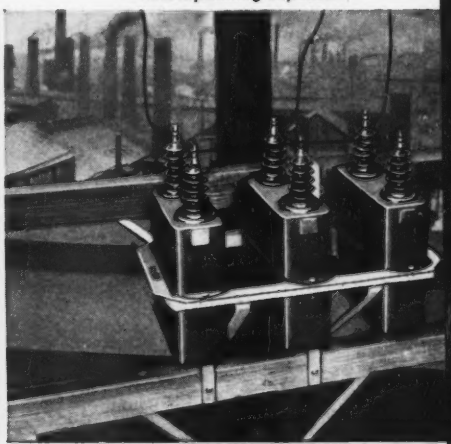
GENERAL ELECTRIC

SMALLEST AND LIGHTEST — WELDED GLASS BUSHINGS — TRIPLE-PROTECTED CASE

Easier to handle and install —unexcelled reliability

Provide high mechanical strength— permanent hermetic seal

Protects even in corrosive atmosphere —cuts repainting expense



CAPACITORS

MOUNT IN ANY POSITION

Complete air evacuation assures high dielectric strength

GENERAL ELECTRIC CAPACITORS ARE SMALLER, LIGHTER—MORE DEPENDABLE

Only 66 pounds for 25 kilovar, 2400-volt unit—saves weight on your poles—no sacrifice in quality

When installing capacitors you want dependability . . . plus ease of handling and installation. You get all three with General Electric Pyranol* capacitors.

RECENT TESTS ON G-E CAPACITORS maufactured in 1931, compared with original test records, reveal no change in electrical characteristics. Control of all materials used in construction provides this stability—for example, the dry-annealed aluminum foil used in G-E capacitors is thoroughly cleaned to remove oil and any contaminants. Complete evacuation prior to impregnation removes all air which could cause failure in service. Testing of each unit at every manufacturing stage assures control of quality and gives you a capacitor that will perform longer under the most severe service.

Easier installation is possible with lighter, smaller G-E capacitors. This reduction in size and weight is achieved with no sacrifice in quality.

*Registered trade-mark of General Electric Company.

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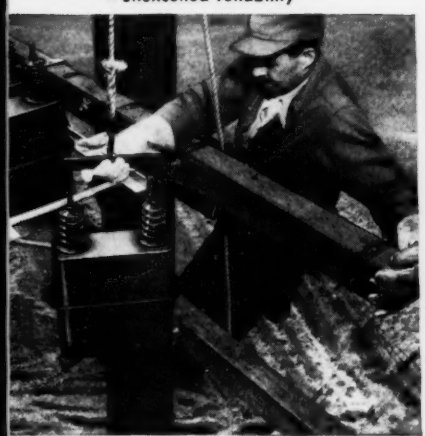
Progress is our most important product

GENERAL ELECTRIC

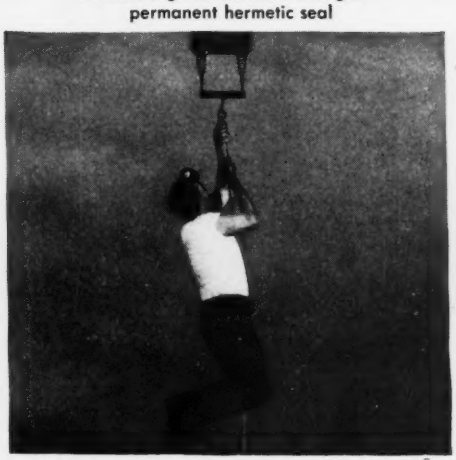
SMALLEST AND LIGHTEST

Easier to handle and install —unexcelled reliability



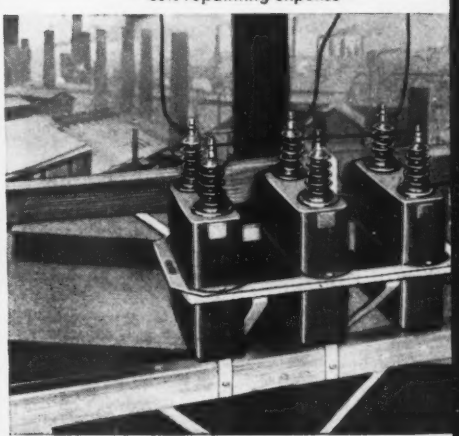
WELDED GLASS BUSHINGS

Provide high mechanical strength— permanent hermetic seal

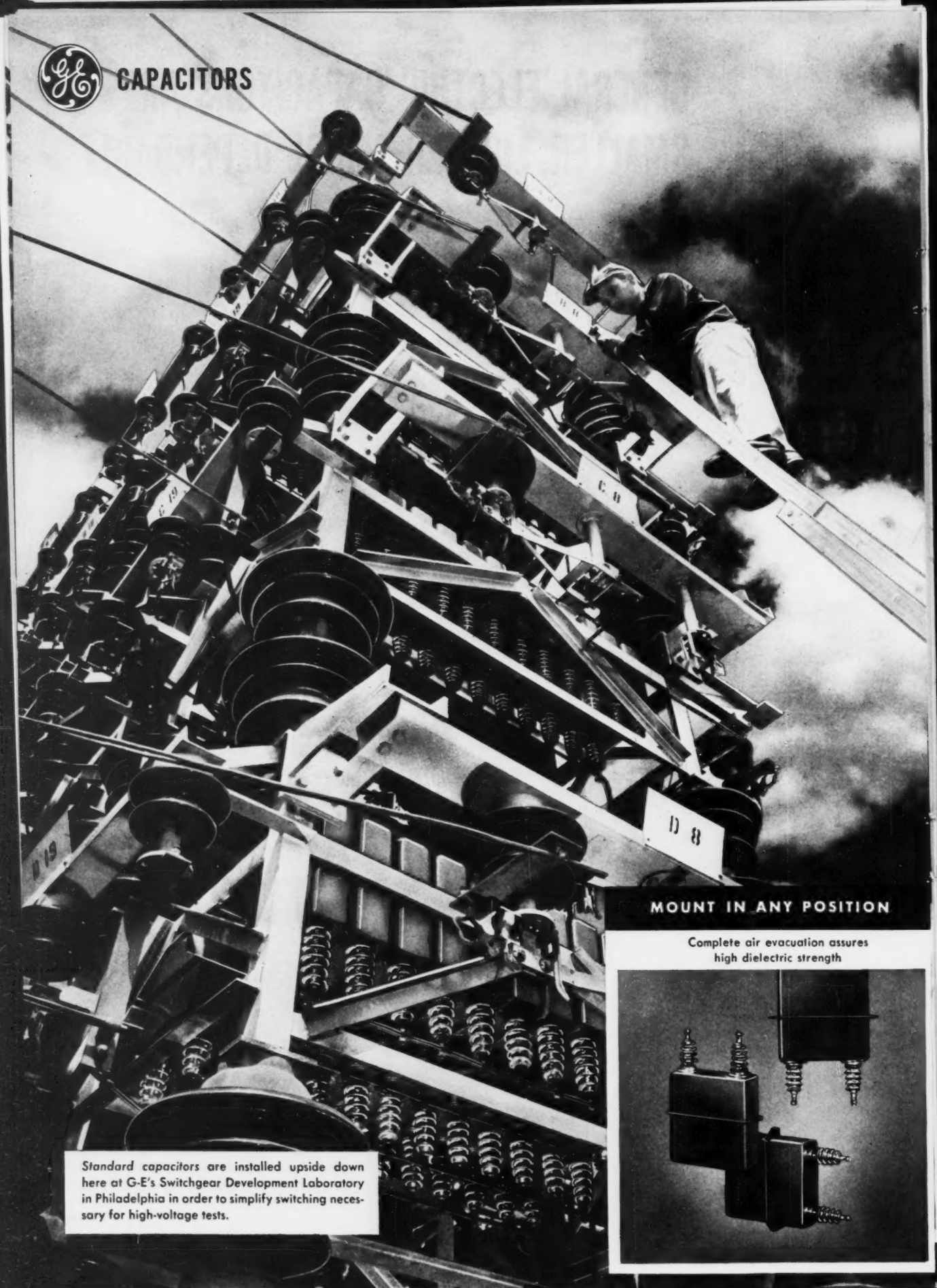


TRIPLE-PROTECTED CASE

Protects even in corrosive atmosphere —cuts repainting expense



CAPACITORS



Standard capacitors are installed upside down here at G-E's Switchgear Development Laboratory in Philadelphia in order to simplify switching necessary for high-voltage tests.

MOUNT IN ANY POSITION

Complete air evacuation assures high dielectric strength

GENERAL ELECTRIC CAPACITORS CAN BE MOUNTED IN ANY POSITION

All air is removed from case and bushing for high insulation strength no matter how installed

General Electric Pyranol* capacitors with glass bushings operate in any position . . . even upside down as shown in this capacitor bank. And the uniformly high strength insulation which makes these applications possible means longer life for all G-E capacitors—no matter how installed.

NO AIR VOIDS in a G-E capacitor—all air and moisture are removed by heat and vacuum before Pyranol impregnation, and the unit is then sealed under Pyranol to prevent re-entry of air. This technique eliminates air voids which might otherwise cause service failure. Combined with sheets of thin, strong Kraft paper, this carefully controlled impregnation assures uniformly high-strength insulation.

Pyranol, the liquid impregnant, completely fills the spaces in the case and in the hollow bushings. Pyranol's high dielectric strength makes possible an unusually small unit with stable operating characteristics and low cost.

*Registered trade-mark of General Electric Company

Remember, whether you need to increase kw capacity of feeders, transformers, regulators, or the entire system back to the generators . . . whether you want to improve feeder voltage levels . . . reduce overall losses . . . or defer the expense of major changes in feeder layout, General Electric Pyranol capacitors are the practical, low-cost solution.

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Progress is our most important product

GENERAL ELECTRIC

SMALLEST AND LIGHTEST

Easier to handle and install —unexcelled reliability

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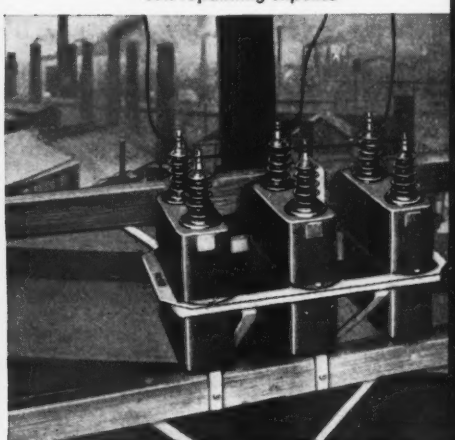


For all system requirements

☑ CHECK General

FOR RUBBER AND P

POWER AND CONTR

For duct and conduit installation, for direct earth burial and sub-marine use as well as for aerial application including self-supporting types.

Rubber or GENCORONE (corona resistant) oil base compound or plastic insulated, with braided, leaded, interlocked or submarine armored finish.

As a principal supplier of power cables to the utility industry, General Cable maintains a modern development laboratory and streamlined, country-wide facilities for manufacture and distribution of types for every electrical service.

Backed by 70 years of close liaison with every phase of utility operation, this experience enables General Cable to plan with you in the cable solution of any problem — generation, control, transmission and distribution.

A call or letter to the nearest General Cable sales office or to headquarters will bring you quick response.

Other principal products made for Utilities include:

Supersheath "Triplets"

Type USE — THERMAX W insulation with neoprene jacket for direct earth burial service entrance.

Type RHWN — THERMAX W insulation with neoprene jacket for aerial, duct, conduit and direct earth burial applications.

Type GN — GENCORONE (corona resistant) insulation with neoprene jacket for medium and high voltage applications — all types.

Bare Wires — Regular and TENSILOK copper, all aluminum and A.C.S.R. conductors.

Weatherproof Wires — OK, PEERLESS (textile covered) TIP-TOP neoprene covered, polyethylene covered; with regular or TENSILOK copper, copperweld, aluminum, or A.C.S.R. conductors.

Service Drop Cables — Copper or aluminum conductor — ENTERITE, type SD, PEERLESS and aerial messenger types.

Service Entrance — SUPERSHEATH type USE, SE style U, SE style A.

Series and Multiple Street Lighting Cables — buried, duct, or aerial (mast arm or arc drop) rubber, GENCORONE, polyethylene or plastic insulated with braided, leaded or plastic jacket.

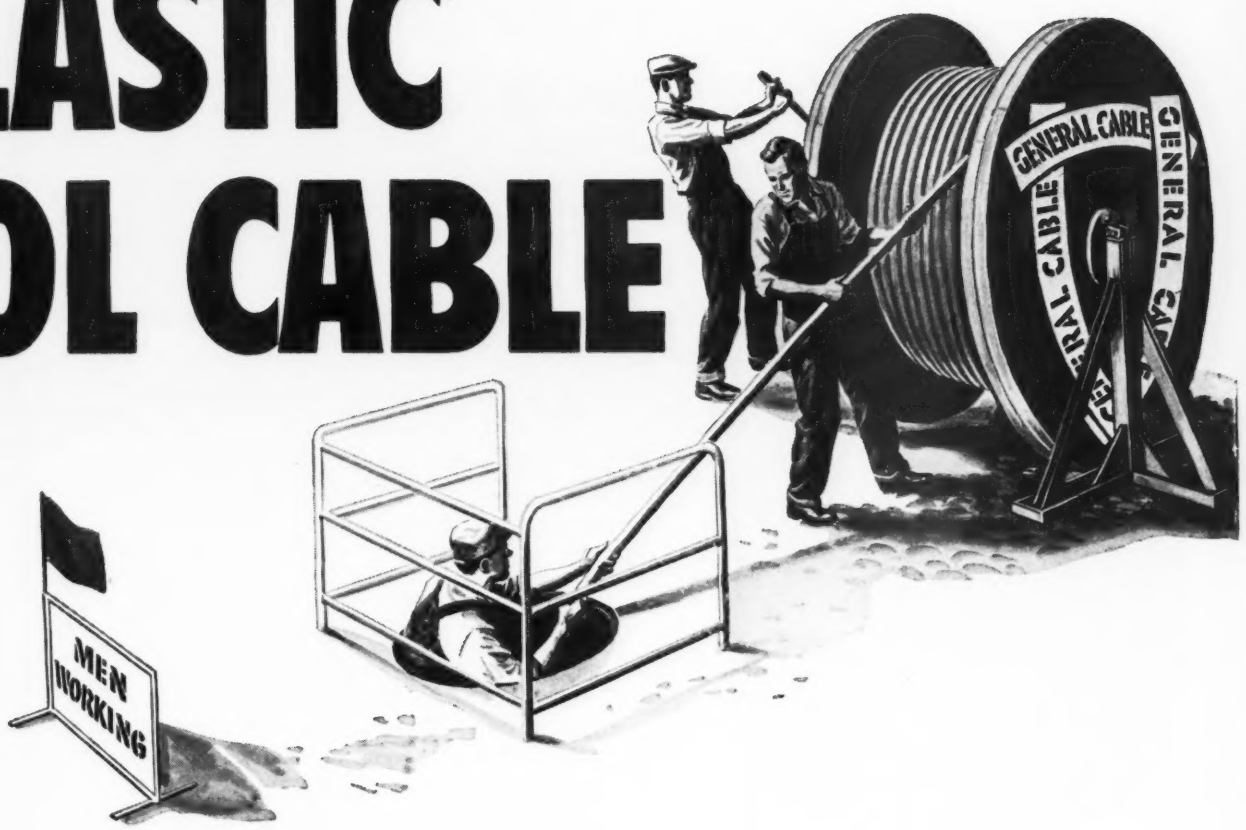
Paper Power Cables — Solid, low pressure gas, and oil-filled, with leaded, neoprene over lead and armored finish. Pipe types (high and low pressure) oil and gas filled. Asbestos-VC, and all Asbestos Station Cables.

Varnished Cambric — power, control, apparatus and station cable, with braided, leaded, and interlocked armored finish.

GUARDIAN Rubber and Plastic Building Wires.

Tree Wire . . . and other types.

Cable 1ST LASTIC OL CABLE



For Prompt, Dependable Information and Service Anywhere in the United States . . . General Cable maintains

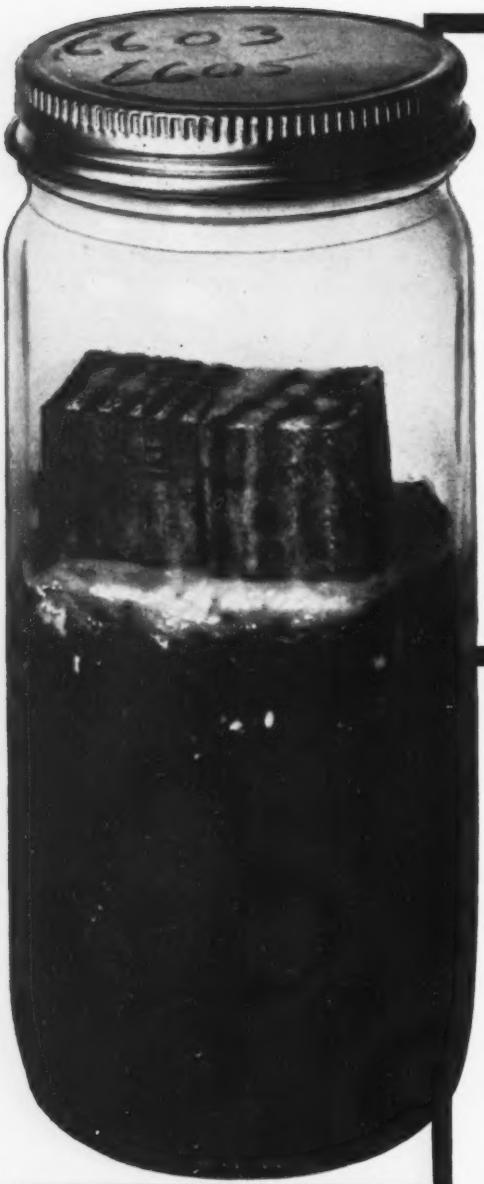
21 Sales Offices
15 Resident Sales Representative Locations
Over **600** Distributor Sales Locations
6 Regional Stock Distribution Points
6 Manufacturing Plants and Stocks

GENERAL CABLE
CORPORATION

GENERAL CABLE GENERAL CABLE GENERAL CABLE

"More Power to You"®

Executive Offices: 420 Lexington Avenue, New York 17, N. Y. • Sales Offices in Principal Cities of the United States



THIS BOTTLE TURNS SEVEN YEARS INTO SEVEN MONTHS

Test blocks of pole wood are fed to destructive fungi in bottles like this at Bell Laboratories. Wood rests on soil which controls moisture conditions and promotes fungus growth. Test speeds search for better preservatives.

This year the Bell System is putting 800,000 new telephone poles into service. How effectively are they preserved against fungus attack and decay?

Once the only way to check a preservative was to plant treated wood specimens outdoors, then wait and see—for seven years at least. Now, with a new test devised in Bell Telephone Laboratories most of the answer can be obtained in seven months.

Cubes of wood are treated with preservatives, then enclosed in bottles with fungus of the most destructive kind, under temperature and humidity conditions that accelerate fungus activity. Success—or failure—of fungus attack on cubes soon reveals the best ways to preserve poles.

The new test has helped show how poles can be economically preserved for many years. It is another example of how Bell Telephone Laboratories works to keep down the cost of your telephone service.

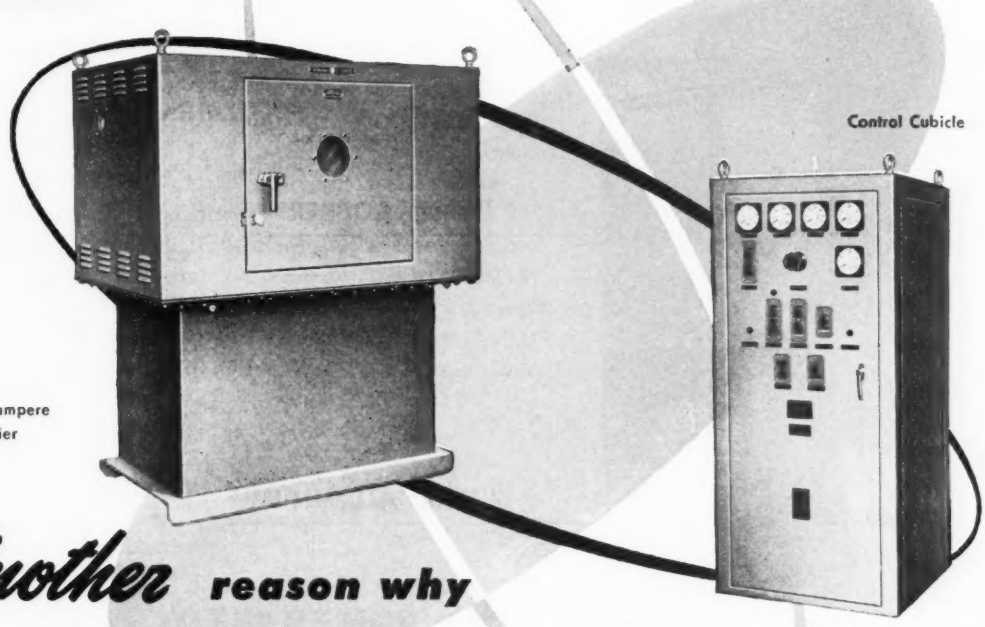
A boring is taken from a pole section to see how far preservative has penetrated. For poles to last, it must penetrate deeply and be retained for a long time.

BELL TELEPHONE LABORATORIES

Improving telephone service for America provides careers for creative men in scientific and technical fields

AEROTEC

electronic Kenotron power supply...



Another reason why

AEROTEC ELECTRICAL PRECIPITATORS

require less maintenance

Aerotec Electrical Precipitators provide long uninterrupted service and require *minimum maintenance*. One reason for this is the exclusive electronic power supply developed for Aerotec Electrical Precipitators which provide these advantages:

1. Complete package unit eliminates field installation problems, cage enclosures and ventilating systems.
2. Control cubicle may be placed on boiler operating floor while rectifier is mounted adjacent to the precipitator.
3. Instantaneous overload protection safeguards Kenotron tubes assuring long life.
4. Electronic power supply eliminates noise, noxious and toxic gases commonly associated with mechanical types.
5. No moving parts; nothing to wear, nothing to lubricate.
6. Rugged constant current network control eliminates operator attention.
7. Rectifier available in weatherproof cubicle for outdoor installation.

In addition to more efficient power supply, Aerotec Electrical Precipitators offer higher collection efficiency by:

- Pocket-type collecting electrodes that prevent dust reentrainment.
- Exclusive high voltage flat plate provides a field of uniform high intensity for maximum precipitation.
- Electromagnetic rappers of low intensity impact clear electrodes of deposit on a continuous short interval basis.

For additional data on Aerotec Electrical Precipitators write or call our project engineers—

Project Engineers **THE THERMIX CORPORATION** Greenwich, Conn.

(Offices in 38 Principal Cities)

Canadian Affiliates: **T. C. CHOWN, Ltd., Montreal 25, Quebec; Toronto 5, Ontario**

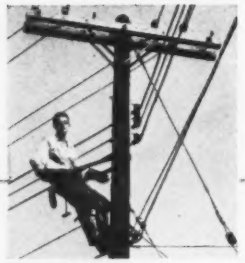
Manufacturers

THE AEROTEC CORPORATION

GREENWICH, CONN.

COPPER or ALUMINUM

which conductor shall it be?



"I say COPPER"

"I say ALUMINUM"

"We both agree on ANACONDA"

It's not very strange that this sort of agreement is widespread today.

Cable customers vary in their needs. Some choose copper . . . some aluminum . . . some both.

To get the best results from either metal, consider carefully both sound engineering and good economics before deciding. Whatever *your* final choice—it will pay you to *specify Anaconda.*

Anaconda offers you a *single* source of supply for transmission and distribution conductors for every type of service. Modern manufacturing techniques are backed by many years of field-engineering and construction experience plus up-to-date metallurgical and development facilities. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y. 52474

Copper and Aluminum Insulated Cables
Copper and Aluminum Service Cables
Copper, Aluminum and Copperweld Bare and Weatherproof
Copper and ACSR Transmission and Distribution
Wire and Cable Accessories

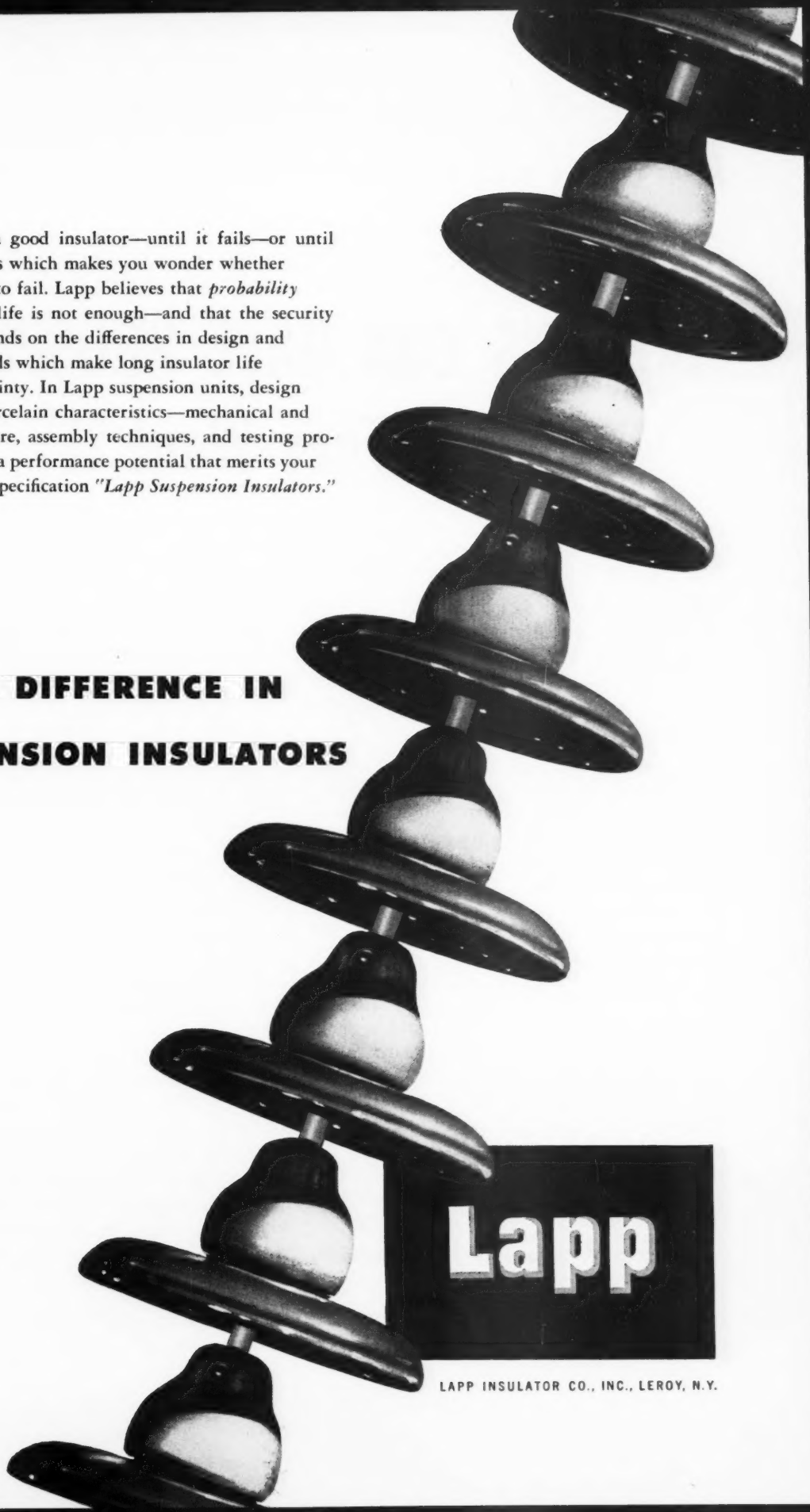
cu or al

—choose with confidence when it's

ANACONDA® wire and cable

Any insulator is a good insulator—until it fails—or until something happens which makes you wonder whether or not it is going to fail. Lapp believes that *probability* of long insulator life is not enough—and that the security of your lines depends on the differences in design and production methods which make long insulator life a predictable certainty. In Lapp suspension units, design considerations, porcelain characteristics—mechanical and electrical—hardware, assembly techniques, and testing procedures, add up to a performance potential that merits your confidence in the specification *"Lapp Suspension Insulators."*

THERE IS A DIFFERENCE IN SUSPENSION INSULATORS



Lapp

LAPP INSULATOR CO., INC., LEROY, N.Y.

BRITONS CAN HAVE PROSPERITY —If They Want It

What is required to get Britain, our key ally in the grand alliance of the free world, firmly back on her economic feet? The purpose of this message is to throw light on this crucial problem, which afflicts our other European allies also.

At the moment, Britain is enjoying a respite from the economic crises (of 1947, 1949 and 1951-52) which have plagued her postwar course. This respite may well continue for some time. But almost no one whose judgment is trustworthy believes that Britain has acquired sufficient economic strength to safeguard her against further economic crises in the years immediately ahead.

Two British Views

New and clear light on what should be done to that end has recently been shed by two noteworthy British publications. One is a book, "We Too Can Prosper," by Graham Hutton, distinguished British economic writer and administrator. The other is an article, "The Riddle of Prosperity," published by THE (London) ECONOMIST, Europe's most eminent economic journal.

Combined, these two publications present in sharp relief the basic problem that must be handled successfully if Britain is to be safely solvent. As is implied by its title, ***the Hutton book demonstrates that Britain can be made prosperous by readily feasible procedures, patterned on what has been done in the United States, to increase its industrial efficiency. But, says THE ECONOMIST, with Mr. Hutton's book in mind, this is not the most basic problem, which is, "How shall we make the British people determined to be prosperous?"*** This is a problem of incentive or motivation.

Compared with that of the United States, average industrial efficiency in Britain, as in most of Western Europe, is low. In his book Mr. Hutton remarks that "fifty years ago an American industrial worker turned out roughly the same amount in a day as his opposite number in Britain, Germany or France. . . . Today, he turns out from two to five times as much."

In large part it is this lag in output per hour or "productivity," as the technicians call it, which makes Britain and other key countries in Western Europe a continuing prey to economic crises. Moreover, the great disparity in productivity between the U.S.A. and most

of Western Europe is a major barrier to knitting the free world into a smoothly working economic whole. As one observer put it, "when the American economy catches a cold, the European economy gets pneumonia." This is largely because Europe is so much weaker in productive strength.

No Shortage of Knowledge

Yet the knowledge which would enable the countries of Western Europe, and particularly Britain, to increase their industrial productivity has been mobilized and is readily available to them. It is with this process for Britain that Mr. Hutton's book is concerned. In the book he summarizes the findings and conclusions, virtually all of them unanimous, of 66 teams, composed of British industrial managers, technicians, shop workers and labor leaders. Over a period of three years these teams completed a comprehensive series of inspection and study trips in the United States under the sponsorship of the Anglo-American Council on Productivity. The product of that effort, he remarks, is "a set of documents the like of which, on such a scale and of such practical value, has never been seen in the history of international and cultural borrowing."

Psychology the Key

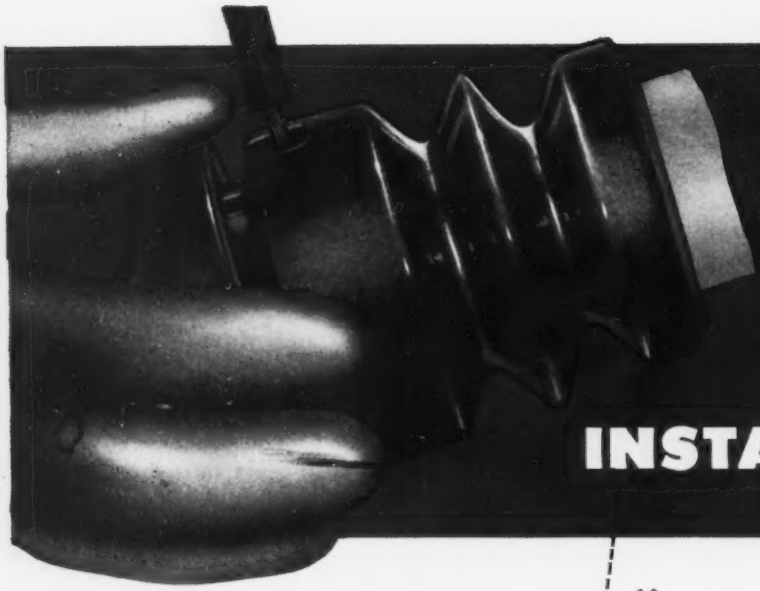
From study of these documents, Mr. Hutton concludes that better capital equipment is the key technical ingredient of higher industrial productivity in Britain, and constitutes "the most urgent . . . need of British industry." But he finds that ***even without new capital equipment a "15% rise in productivity can still be achieved by reorganization of work," and that such an increase would "solve Britain's chief social and economic problems."***

Then why is not such an increase in productivity, demonstrated by the Anglo-American productivity teams to be so clearly within technical grasp, promptly forthcoming? Mr. Hutton, quoting one of the team reports, remarks that, ***"'the greatest obstacles to increased productivity are psychological rather than technical.'*** We have to deal first and foremost with men, not machines." And THE ECONOMIST, pursuing the line of inquiry suggested, reaches the conclusion that, by and large, the people of Britain do not want to prosper by being more efficient. THE ECONOMIST says:

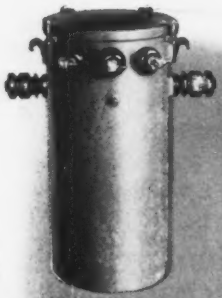
> "The real secret of American productivity is that American society is imbued through and through with the desirability, the rightness, the morality of production. . . . But in Britain, if any moral feeling at all survives about economic matters, it is usually a vague suspicion that economic success is reprehensible and unworthy. From this difference in attitudes everything else follows."

"How," asks THE ECONOMIST, "shall we set about restoring some belief in the rightness of effort, the morality of success?" For this question it has no ready answer. Neither have we. We are confident that the British people will neither be cajoled nor coerced into trying to match our productivity. Basically the problem seems to be to demonstrate clearly to them the truth of the proposition, set down by Graham Hutton, that "there is no goal, aim or end before a Good Society which the raising of that society's material productivity cannot render easier of achievement." Doing that in an old and settled country like Britain is obviously an extremely formidable undertaking. But ***until it is done, the crucial job of getting Britain and the rest of Western Europe firmly on its economic feet will remain to torment all of us.***

McGraw-Hill Publishing Company, Inc.

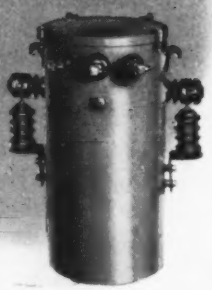


FOR SAFE, EASY, FAST INSTALLATIONS



Type A, OISC conventional distribution transformer, 15 KVA, single-phase, 60-cycle, with side wall mounted high voltage bushings. Standard construction for voltages 5 KV and less, and sizes through 100 KVA.

DISTRIBUTION TRANSFORMERS



Type CSP, OISC distribution transformer, 15 KVA, single-phase, 60-cycle, with primary lightning arresters, internal fuses, low voltage circuit breaker and side wall mounted high voltage bushings. Standard construction for voltages 5 KV and less and sizes through 100 KVA.

You make primary line connections the new, improved way on STANDARD'S 2400 or 4800 volt Distribution Transformers. Working closely with operating men in the field, The Standard Transformer Company developed time-saving Tank Wall Bushings which permit flick-of-the-wrist installations . . . without tools. No "live parts" exposed . . . terminal compression stud keeps easy-to-grip, insulated porcelain cap from falling off when unscrewed to receive primary lines. Cable can be brought in from either side and held securely by pressure from clamping shoe.

Perfected side mounted bushings, plus additional sound basic construction features, make STANDARD'S 2400 or 4800 volt Transformer one of the best buys on the market today. When you specify STANDARD you get a transformer with easily-removed covers, moisture-proofed with a Neoprene gasket which prevents oil leakage; a low-loss core assembly housed in a rugged, all-weather, copper-bearing steel tank; a core assembly made of non-aging, varnish-coated, silicon steel sheets. These features mean a long-lived, trouble-free transformer . . . silently, efficiently working for you.

Write for specific information on new Tank Wall Bushings.

Everything Points To...

Standard

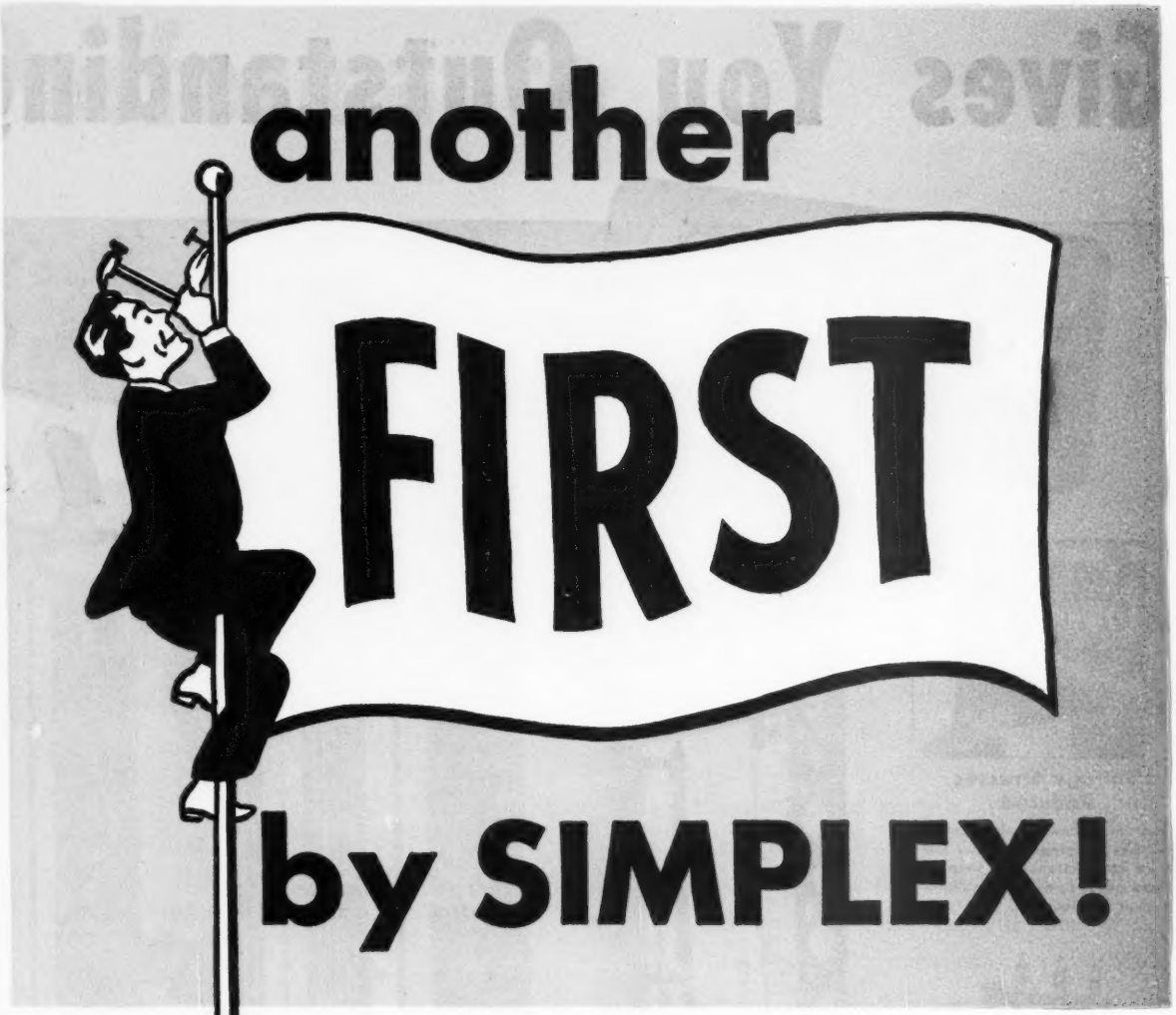
THE STANDARD TRANSFORMER COMPANY

WARREN, OHIO

REPRESENTATIVES IN PRINCIPAL CITIES

WRITE FOR BULLETIN CL-50

Tells the story with words and pictures of STANDARD'S complete line of transformers, and how they perform for every class of service . . . on the job.



The announcement of another "First" by Simplex is coming next month. It's another "First" to add to the distinguished company of the many others that have come from Simplex laboratories.

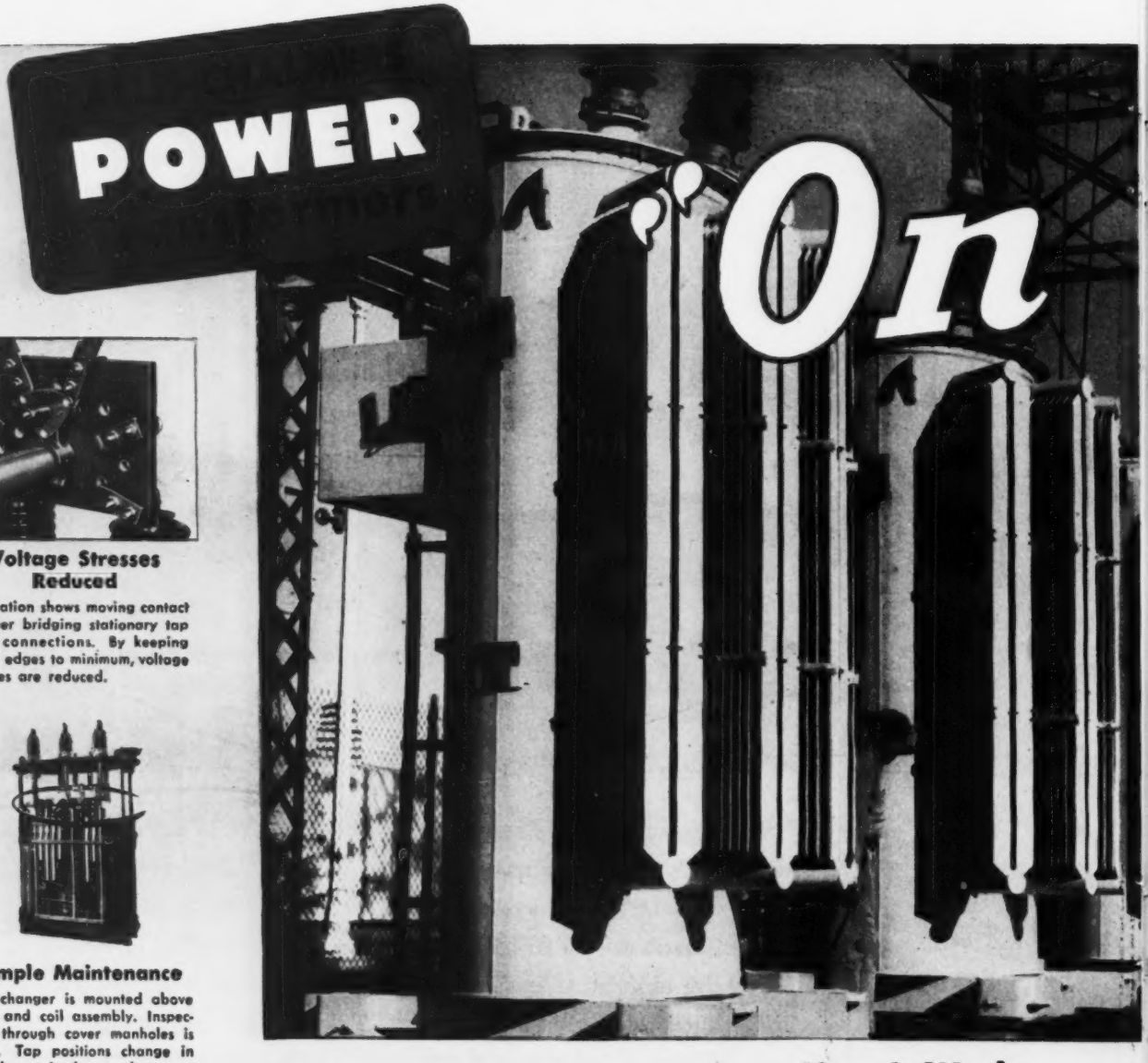
It will rank with TIREX "cured-in-lead" jackets, ANHYDREX low water-absorptive insulation, Simplex rubber-jacketed cables, TIREX gear-shaped insulated cables, ANHYDREX high temperature rubber insulation, and many others which have contributed so much to the perfection of rubber insulations.

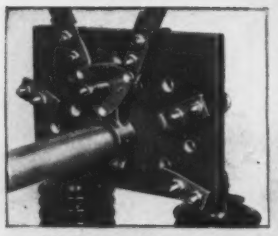
Watch for the announcement. It will be important to you.

Simplex WIRE & CABLE CO.

79 Sidney Street, Cambridge 39, Mass.

Gives You Outstanding



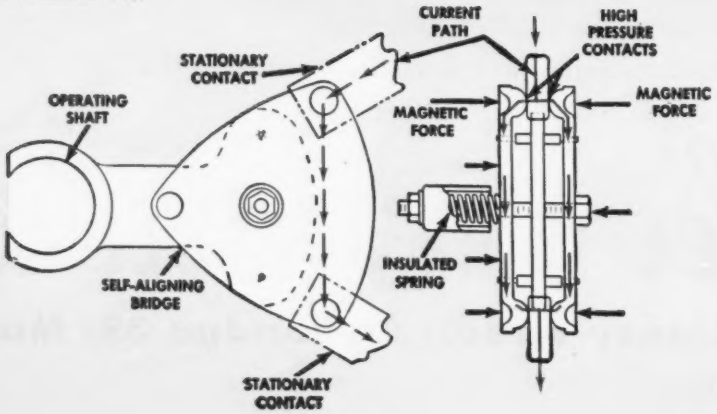


Voltage Stresses Reduced

Illustration shows moving contact member bridging stationary tap lead connections. By keeping sharp edges to minimum, voltage stresses are reduced.

Simple Maintenance

Tap changer is mounted above core and coil assembly. Inspection through cover manholes is easy. Tap positions change in all phases simultaneously.



How It Works

A positive flow path is established under high unit pressure by a round point on a flat contact surface. High unit pressure promotes low contact resistance, deters heating.

Parallel plates form movable contact bridge. Magnetic forces that are set up as a result of the flow of parallel currents in the bridge prevent "throw open" when a short circuit occurs.

Get the illustrated data sheet with all the details from your nearest A-C office or write Allis-Chalmers, Milwaukee 1, Wis.

Performance

the Line"

What power transformer is best for your system? This decision is difficult — transformers may look alike, have standardized ratings and specifications. Yet, there is *one big variable* — QUALITY — that *extra* measure of value which means better continuity of service.

For over a half century Allis-Chalmers has been earning the approval of utility men who say A-C transformers give outstanding performance. You can depend on Allis-Chalmers design, construction and attention to details because experience proves you get the most advanced, the most economical answer to your problems from A-C.

All of this adds up to reliability, versatility and ease of operation. Make sure you talk over your next power transformer requirements with Allis-Chalmers.

A-4009

This Tap Changer Design Gives The Advantage of Point Contact

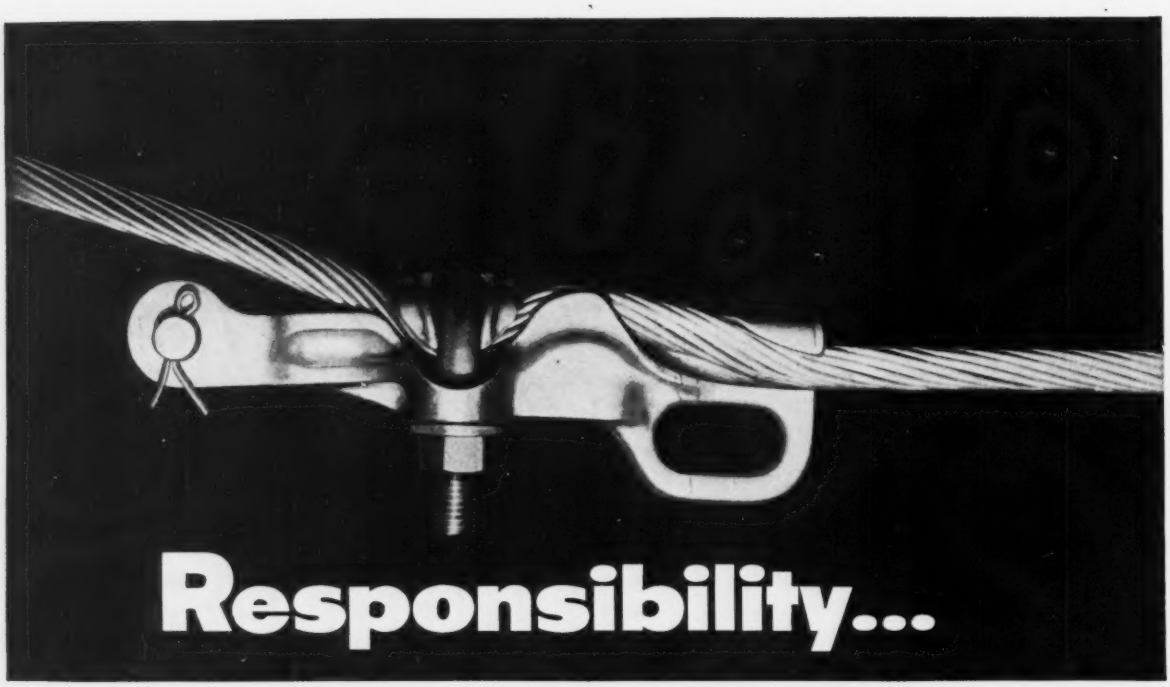
YOU CAN SEE from the diagram at left how the rounded point on a flat surface establishes a single current path per contact. This tap changer design meets five requirements for good design:

- Contact members are flexible and self-aligning.
- Provides equal and positive contact pressure.
- Magnetic forces utilized to increase contact pressure.
- Gives a single established current path per contact.
- Strong wiping action cleans contact thoroughly when tap positions are changed.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

Milwaukee 1, Wisconsin



and a popular anchor clamp

Growing demand for a small, convenient clamp for all-aluminum cable in urban distribution lines brought the response to be expected from Alcoa.

The newest Alcoa anchor clamp, cast from tough aluminum alloy, handles limited tensions up to 2,500 pounds on 4/0 cable and 3,000 pounds on 336,400 cm cable, while the clamp provides tensile strength of 5,000 pounds between pin and pulling eye.

By developing two unique features, Alcoa engineers were able to evolve a single U-bolt design lending itself to rapid, easy installation. One of these is the three-point, graduated snubbing effect. The other is the U-bolt, itself. It matches the coefficient of expansion of both clamp and conductor. Its flattened cross section where it bears on the keeper avoids high stress concentration. Its fine threading permits high pressure to be developed without excessive manual effort.

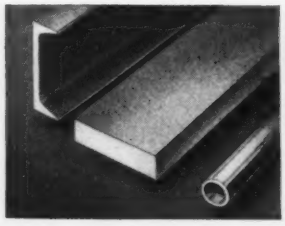
This new addition to a growing accessory line is another example of Alcoa responsibility in action to help insure the best service from the best product. A responsibility undertaken more than 55 years ago when Alcoa introduced aluminum electrical conductor and still hard at work today for you. Aluminum Company of America, 2100-J, Alcoa Building, Pittsburgh 19, Pennsylvania.

Alcoa Aluminum

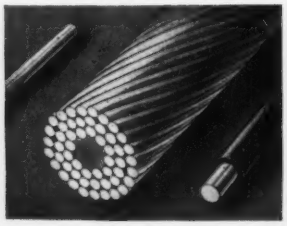
ALUMINUM COMPANY OF AMERICA

"SEE IT NOW" with Edward R. Murrow —CBS-TV every Sunday . . . brings the world to your armchair. Consult your newspaper for local time and channel.

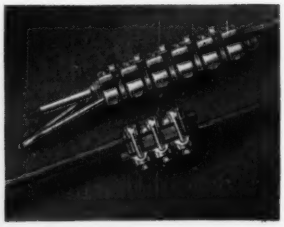
Alcoa Aluminum Bus is available in rectangular and solid round bars, channels and tubular shapes.



Alcoa Aluminum Electrical Conductors include ACSR, solid and stranded aluminum wire, bare or covered.



Alcoa's full line of aluminum accessories is correctly designed for use with all aluminum conductors.

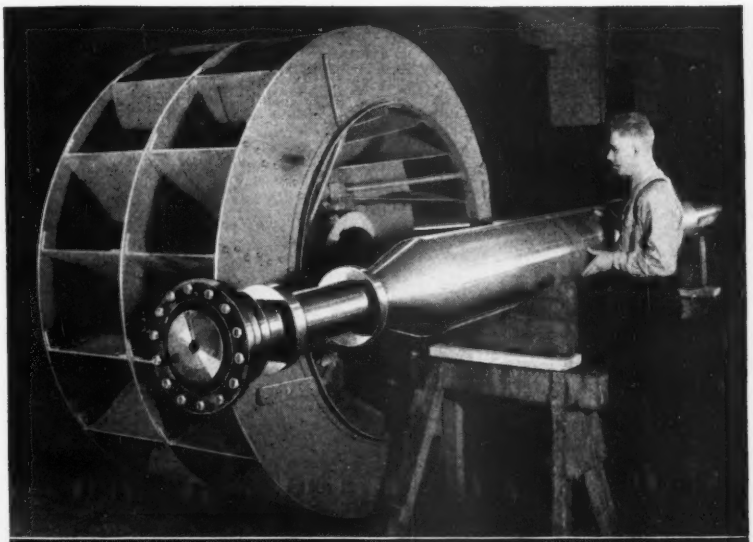


"Buffalo"

Fan Features that Reduce DRAFT Costs

1. STRENGTH

In such severe service as mechanical draft, the "cheapest" fan is the one that lasts longest. "Buffalo" Fans are built for the longest possible life. Note the heavy, rigid construction of the "Buffalo" rotor shown at right, and the oversized shaft turned from one solid steel forging, thrust collars and all. This is typical of the strength and endurance built into every "Buffalo" Draft Fan—strength that means far less repair and replacement cost through added years of service.



2. ENGINEERING

"Buffalo" Engineering "know-how" is back of the high efficiency and favorable pressure characteristics of "Buffalo" Forced Draft, Induced Draft and Primary Air Fans. These characteristics mean stable delivery over widely varying fuel requirements—minimum erosive action on Induced Draft—minimum driving power on all fans.

3. SERVICEABILITY

Accessibility of all parts is a "must" if servicing is to be done rapidly and economically. At right is a "Buffalo" Induced Draft housing, showing the sectional, bolted design and access hatch. Cleaning, coating, rotor balancing—even rotor removal—are greatly simplified.

For further features that give you lower draft costs—plus more dependable draft —write today for Bulletin 3750.

FIRST FOR FANS

BUFFALO FORGE COMPANY

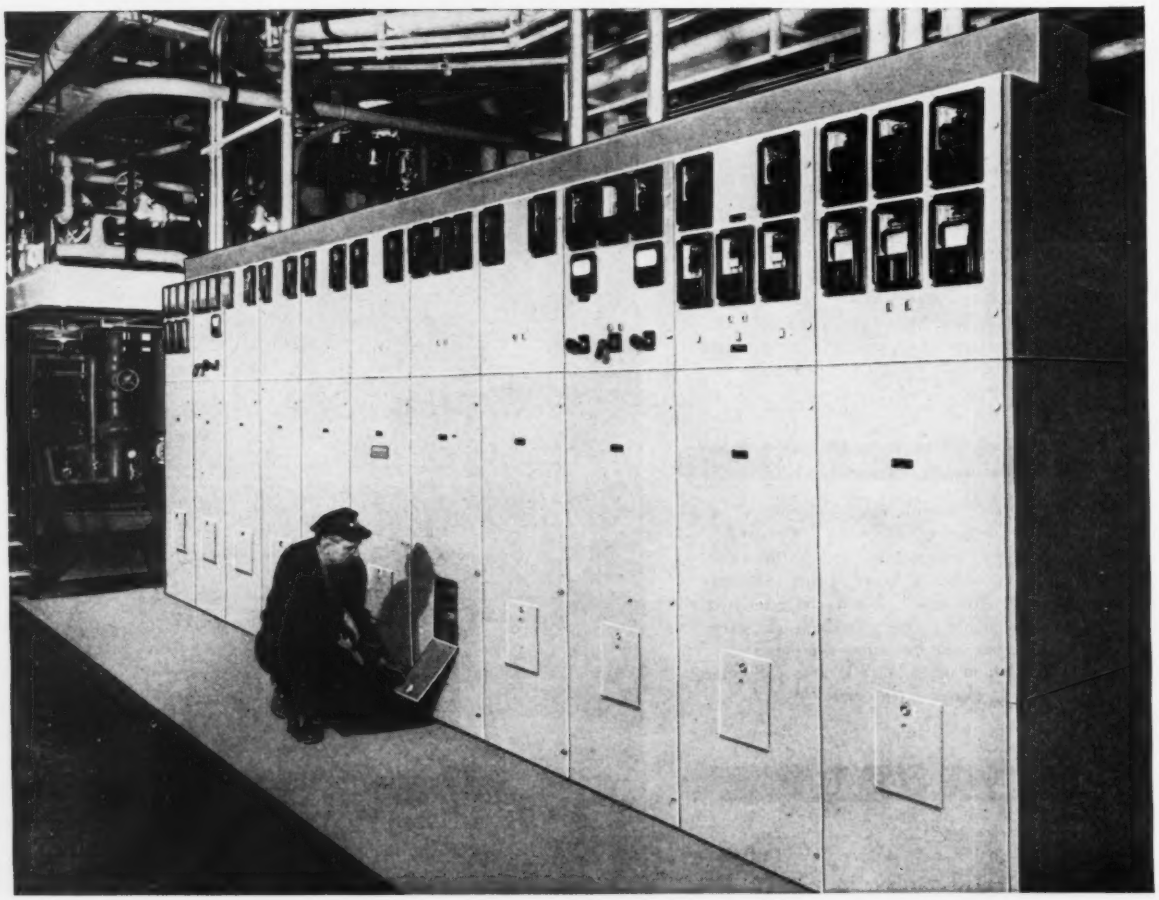
212 MORTIMER ST. BUFFALO, NEW YORK

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

VENTILATING FORCED DRAFT | AIR CLEANING COOLING | AIR TEMPERING HEATING | INDUCED DRAFT PRESSURE BLOWING | EXHAUSTING

Specify I-T-E switchgear....



Typical installation of Metal-Clad Switchgear. Shown here at the Tucson Gas & Electric Light & Power Co.

Total cost is the important figure, when comparing makes and types of switchgear. What will the overall cost be, after the switchgear is *installed* and *operating?* Engineering and planning time—as well as installation, maintenance, and operating costs—must all be included in this total.

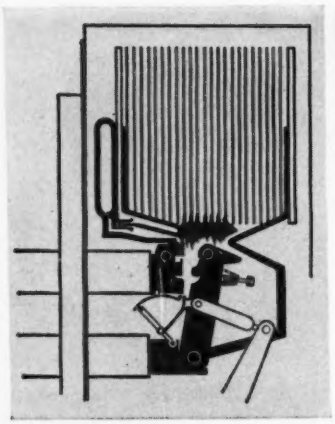
The purchase of I-T-E Metal-Clad Switchgear provides a long series of tangible savings—savings felt during every stage of electrical expansion and new construction.

PLANNING ASSISTANCE

An I-T-E Application Engineer has the experience to help you select coordinated equipment for your specific application problem. This releases your own technical and purchasing staffs for broader planning duties.

for over-all economy

Consider these important benefits from I-T-E Metal-Clad Switchgear:



1

Proved performance and reliability

Superiority of the I-T-E method of arc interruption—*in air*—is thoroughly proved by the thousands of efficient I-T-E power circuit breakers now in service.

2

Quick delivery

Through the years, I-T-E has maintained an enviable record in fulfilling delivery promises. Prompt shipment of switchgear helps to keep construction on time or even ahead of schedule.

3

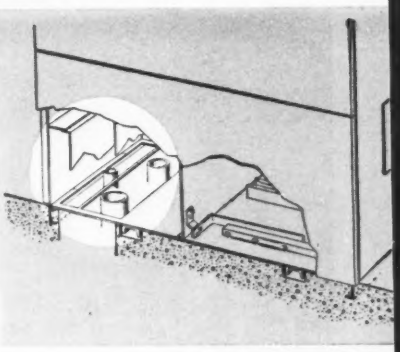
Simplified testing

I-T-E's unique "fast-test" feature permits secondary circuit testing without opening the circuit breaker compartment door. Racking the horizontal drawout breaker to test position gives safe immediate access to the operating station. Breaker is available for testing in a matter of seconds.

4

Simplified installation

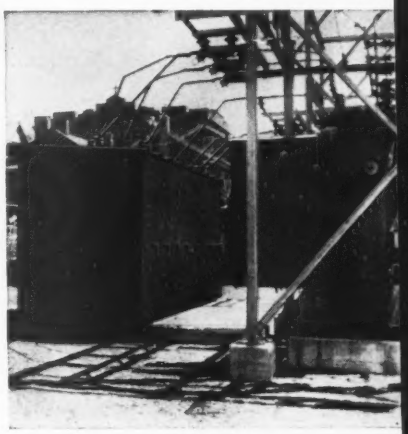
I-T-E switchgear is assembled, tested, and shipped as a complete unit. Floor plan drawings are sent in advance to permit immediate installation of channel base and positioning of conduit or cable. All that remains is to position the switchgear and make necessary connections.



5

Long, trouble-free life

I-T-E selection of premium materials and components pays dividends in long equipment life. Every detail of I-T-E Multumite construction points to continuous, trouble-free service even under the most severe operating conditions.

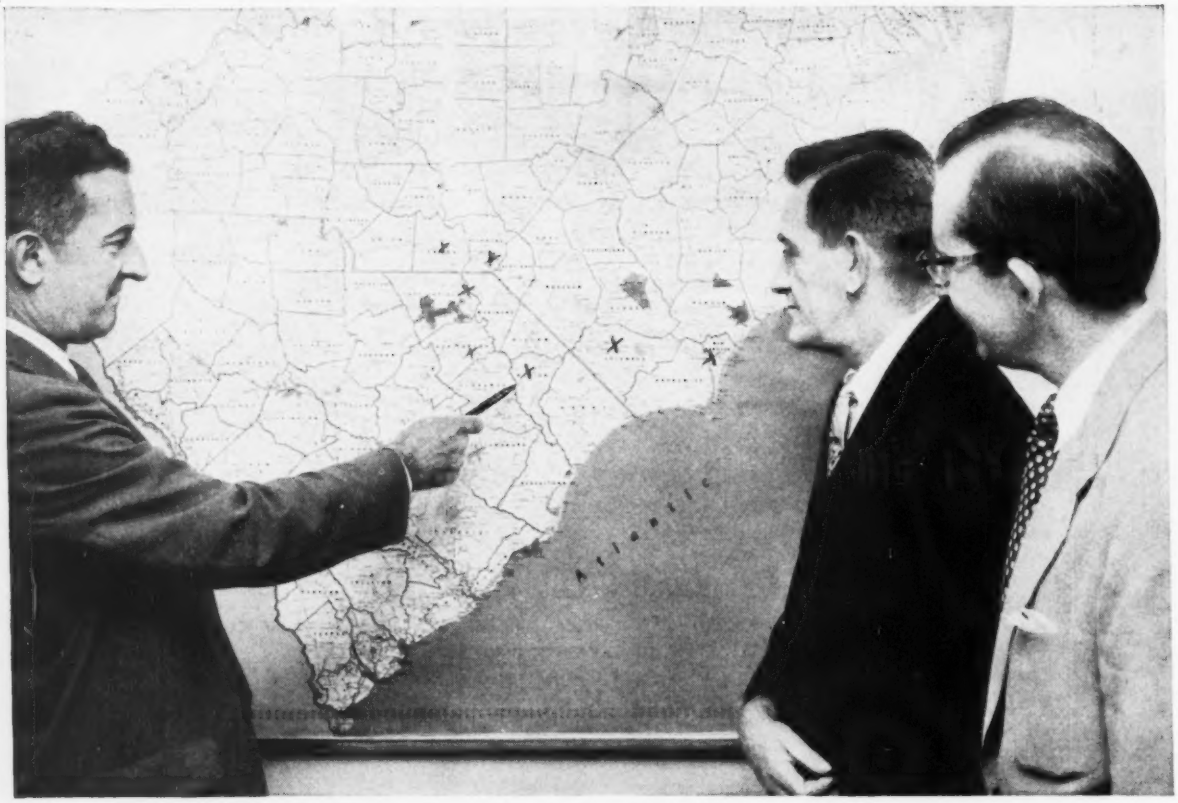


For details call the I-T-E field office nearest you. Look in the classified section of your telephone directory under "Electrical Equipment". Or write for *Catalog Sec. 7000.* I-T-E Circuit Breaker Co., *19th and Hamilton Sts., Philadelphia 30, Pa.*

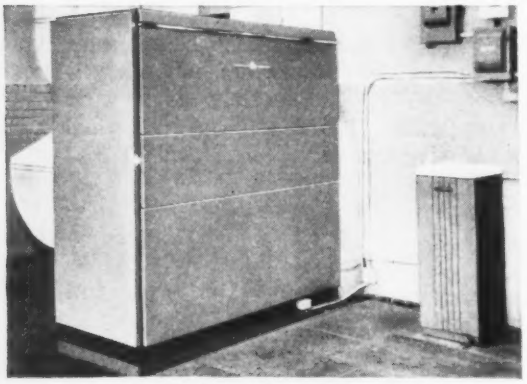
I-T-E

METAL-CLAD SWITCHGEAR

CAROLINA POWER and "...finest boost for all-



TWELVE OFFICES of the Carolina Power and Light Company have G-E Weathertron installations. Mr. J. G. Richert, Jr., Vice-President and Manager of District Operations, discusses their location with T. B. Smiley, Residential and Rural Sales Manager, and William P. McPherson, Commercial Sales Manager. Nine 3-horsepower G-E Weathertron units are located at Oxford, Zebulon, Hamlet, Wadesboro, Jacksonville and Whiteville, North Carolina; and Marion, Cheraw, Kingstree and Darlington, South Carolina. Larger 5-horsepower G-E Weathertrons are installed in the Company's Morehead City and Wilmington offices in North Carolina.



A FULL YEAR of continuous operation of this G-E Weathertron unit has provided clean, comfortable, efficient working conditions for employees of the Oxford, N. C. office of Carolina Power and Light.

HOW THE GENERAL ELECTRIC WEATHERTRON WORKS

Based on the heat pump principle, the G-E Weathertron heats in winter by extracting heat from outdoor air and delivering it indoors; in warmer weather, it automatically reverses itself and extracts heat from indoor air and pumps it outdoors.

WEATHERTRON

All-Electric Cooling and Heating

LIGHT calls HEAT PUMP electric living we've yet seen."

"The fact that our Residential Customers are using on the average 3203 kilowatt hours annually is ample proof of their willingness to use liberally those electric services that contribute most to happiness and better living.

"For several years now we have had each year an increasing customer interest in electric heating and air conditioning. The development of the heat pump has given marked impetus to that public interest. Now that both jobs can be done with one machine we fully expect to have a large and rapid growth of our year-round load that before long will dwarf the substantial increases made each year as a result of wide dealer sales of major home appliances.

"Elsewhere on this page are statements concerning the number of heat pump installations made in our Company offices. These installations have been made in strategic centers with the idea that they will adequately perform the primary function of heating and cooling our offices. More than that,

HUGH ISLEY, General Sales Mgr., Carolina Power and Light Company

however, we anticipate that these installations will give our residential and commercial customers a close look at a service that is the finest boost for all-electric living we've yet seen."

Utilities are promoting the heat pump because:

1. **Its use can triple or quadruple** normal residential power consumption in the average all-electric home. It means increased kilowatt hour sales throughout the year.

2. **It means real all-electric living** is a practical reality for the first time. All-electric cooling and heating with the G-E Weathertron rounds out the theme of all-electric living and gives utilities an unparalleled opportunity to promote the completely electrified home.

3. **It offers a solution** to the difficult seasonal load problem caused by the increasing use of summer air conditioning unbalanced by a corresponding winter load. The all-electric G-E Weathertron can help smooth out these peaks.

FOR MORE INFORMATION about the G-E Weathertron, including technical data and promotional literature, or plans for a cooperative promotional program, send the coupon or write to General Electric Company, Weathertron Department, Air Conditioning Division, Sec.EW-6, Bloomfield, New Jersey.

AVAILABILITY. The G-E Weathertron is now available in selected areas, principally in the south, southwest, and on the west coast. It will be made available in other parts of the country as soon as suitable distribution and service facilities are established.

G-E Heat Pump now called G-E Weathertron

After years of laboratory research and field development, General Electric introduced the all-electric heat pump commercially last year.

Encouraged by unusual consumer acceptance of this new way of cooling and heating, G.E. initiated larger-scale production for 1953 and, to indicate more clearly the unique benefits of this product, the name was changed to the G-E Weathertron.

General Electric believes firmly in the future of all-electric cooling and heating and has instituted a series of campaigns to architects and consumers to acquaint them with this newest advance in modern living.

GENERAL ELECTRIC

MAIL COUPON TODAY

General Electric Company, Air Conditioning Division, Weathertron Department, Sec.EW-6, Bloomfield, N. J.

☐ Please send me technical and promotional data on the G-E Weathertron.

☐ Please contact us to discuss your plans for Weathertron promotion in our service area.

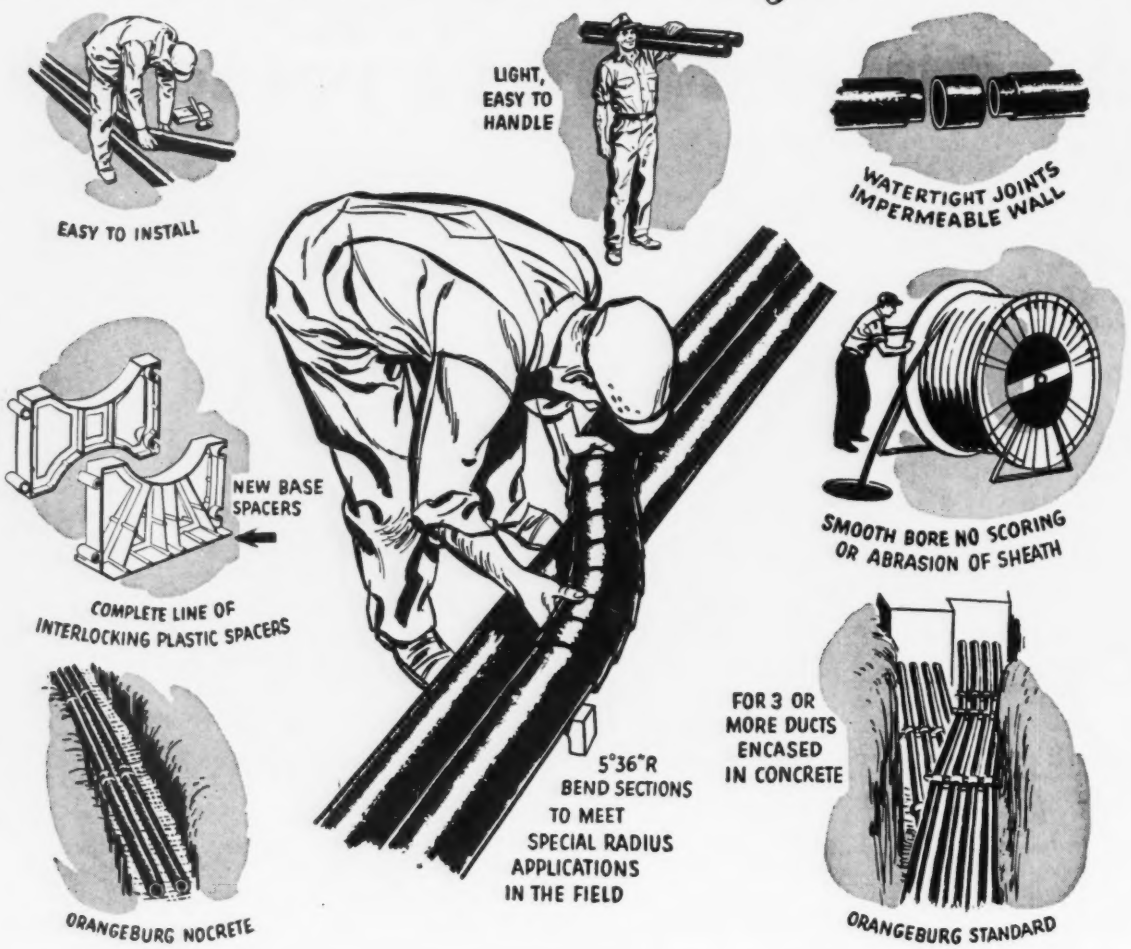
Name and Title .....

Company .....

Address .....

City ..... State .....

1893 60th Anniversary 1953


EASY TO INSTALL
LIGHT, EASY TO HANDLE
WATERTIGHT JOINTS IMPERMEABLE WALL
NEW BASE SPACERS
COMPLETE LINE OF INTERLOCKING PLASTIC SPACERS
SMOOTH BORE NO SCORING OR ABRASION OF SHEATH
5°36'R BEND SECTIONS TO MEET SPECIAL RADIUS APPLICATIONS IN THE FIELD
FOR 3 OR MORE DUCTS ENCASED IN CONCRETE
ORANGEBURG NOCRETE
ORANGEBURG STANDARD

Why Design Engineers Specify Orangeburg Fibre Conduit

Public Utilities, Municipalities and Industry use Orangeburg Fibre Conduit because they know from experience that its many high-quality features provide complete protection for underground cables at minimum cost.

Orangeburg's impermeable wall and water-tight joints prevent corrosive ground waters from entering. Its low coefficient of friction keeps pulling tensions on cables to minimum—safeguards cable sheath from abrasion when pulled in. It does not corrode —resists acids, alkalies, salt, grease, oil. Orangeburg lasts indefinitely underground.

Then there's the *economy factor.* Experience has proved that Orangeburg lays faster and at lower cost than any other type of conduit. And Orangeburg's Bend Sections and full line of fittings contribute additional economies.

Design engineers have many reasons for specifying Orangeburg Fibre Conduit . . . their main objectives being *longer cable life* and lower installed cost. Send to Dept. EW93 for Bend Section Folder. Orangeburg Manufacturing Company, Inc., Orangeburg, New York.

ORANGEBURG® FIBRE CONDUIT

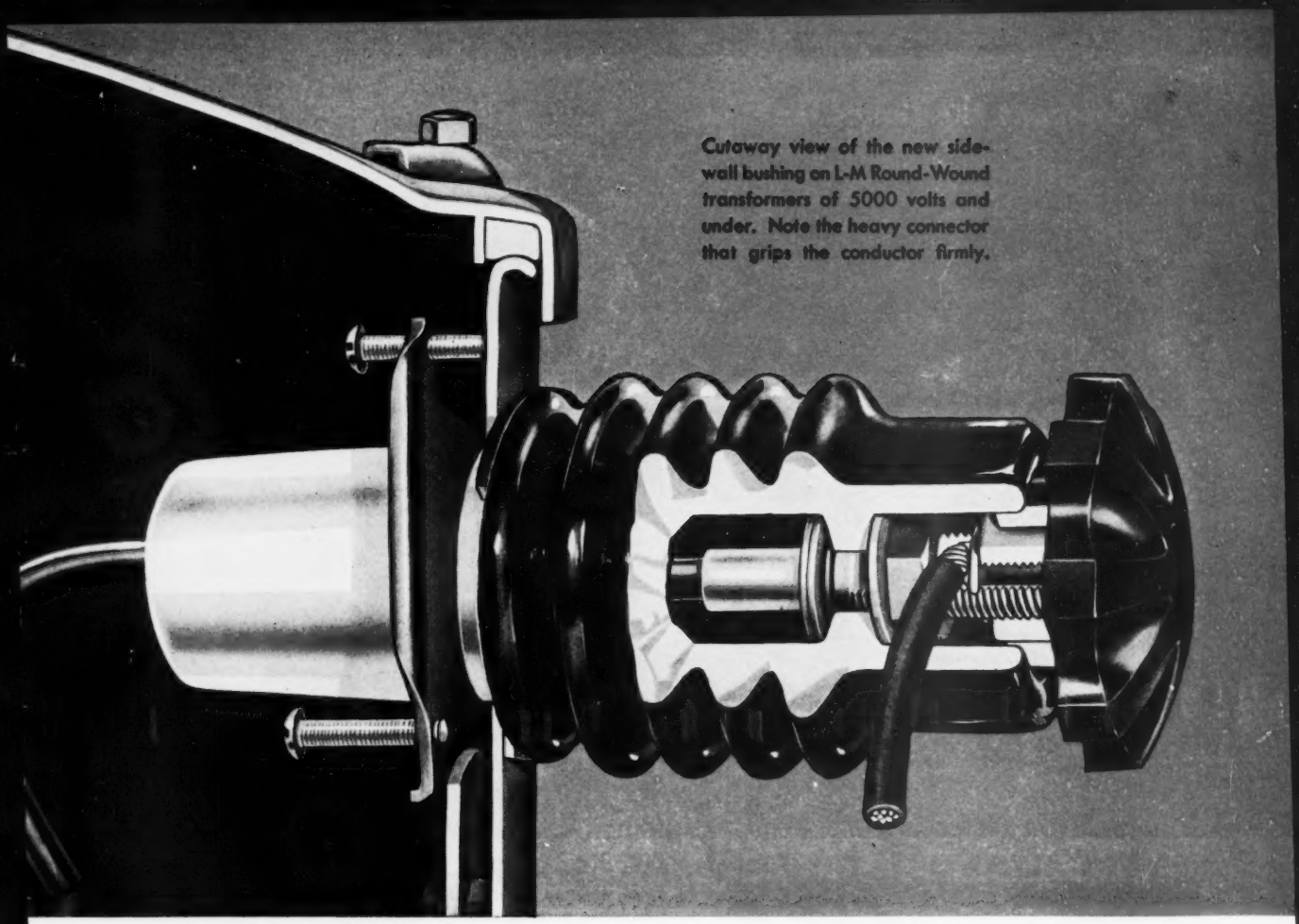
STANDARD INSTALLED WITH CONCRETE

NOCRETE INSTALLED WITHOUT CONCRETE

GENERAL ELECTRIC SUPPLY COMPANY
A DIVISION OF GENERAL ELECTRIC DISTRIBUTING CORPORATION

DISTRIBUTORS, ORANGEBURG FIBRE CONDUIT
BRANCHES AND STOCKS IN PRINCIPAL CITIES

GraybaR ELECTRIC COMPANY



Cutaway view of the new sidewall bushing on L-M Round-Wound transformers of 5000 volts and under. Note the heavy connector that grips the conductor firmly.

L-M's Improved Sidewall Bushings Assure Safer, Faster Installations

L-M's new sidewall transformer bushings permit building transformers lower and lighter, so they require less pole space. These bushings are standard on all transformers of 5000 volts and below.

The bushings have been improved, to make connections faster, safer, and easier. Linemen will like these new bushings, and will be able to make transformer installations in less time.

Bushings are wet process porcelain. Knobs are made of a specially developed thermo-setting phenolic resin plastic modified with a rubber filler. This combination assures unusual resilience and toughness.

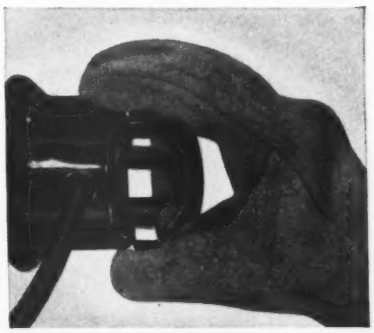
Knobs are large, giving plenty of leverage. Even with gloved hands the lineman gets a firm grip, so that finger-tightening is all that's necessary for a permanent connection.

The heavy connector grips the conductor firmly. The bushing will accommodate a range of conductors from *one* of the smallest to *two* of the largest EEI-NEMA-Standard sizes.

Bushing design is leak-proof and inherently siphon-proof; moisture can't be drawn in; oil can't seep out.

Get Full Information About L-M Round-Wound Transformers

In addition to their outstanding performance characteristics, L-M Round-Wound distribution transformers have many desirable features like this bushing. Get the whole story from the L-M Field Engineer; or write for Bulletin DT1. Line Material Company, Transformer Division, Zanesville, Ohio (a McGraw Electric Company Division).



Corners of the indentations in the plastic knob are sharply molded to provide a firm grip even for gloved hands. Knob does not come off accidentally, but can be removed for inspection.

"Round-Wound" is a Line Material Company trademark

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LINE MATERIAL Transformers

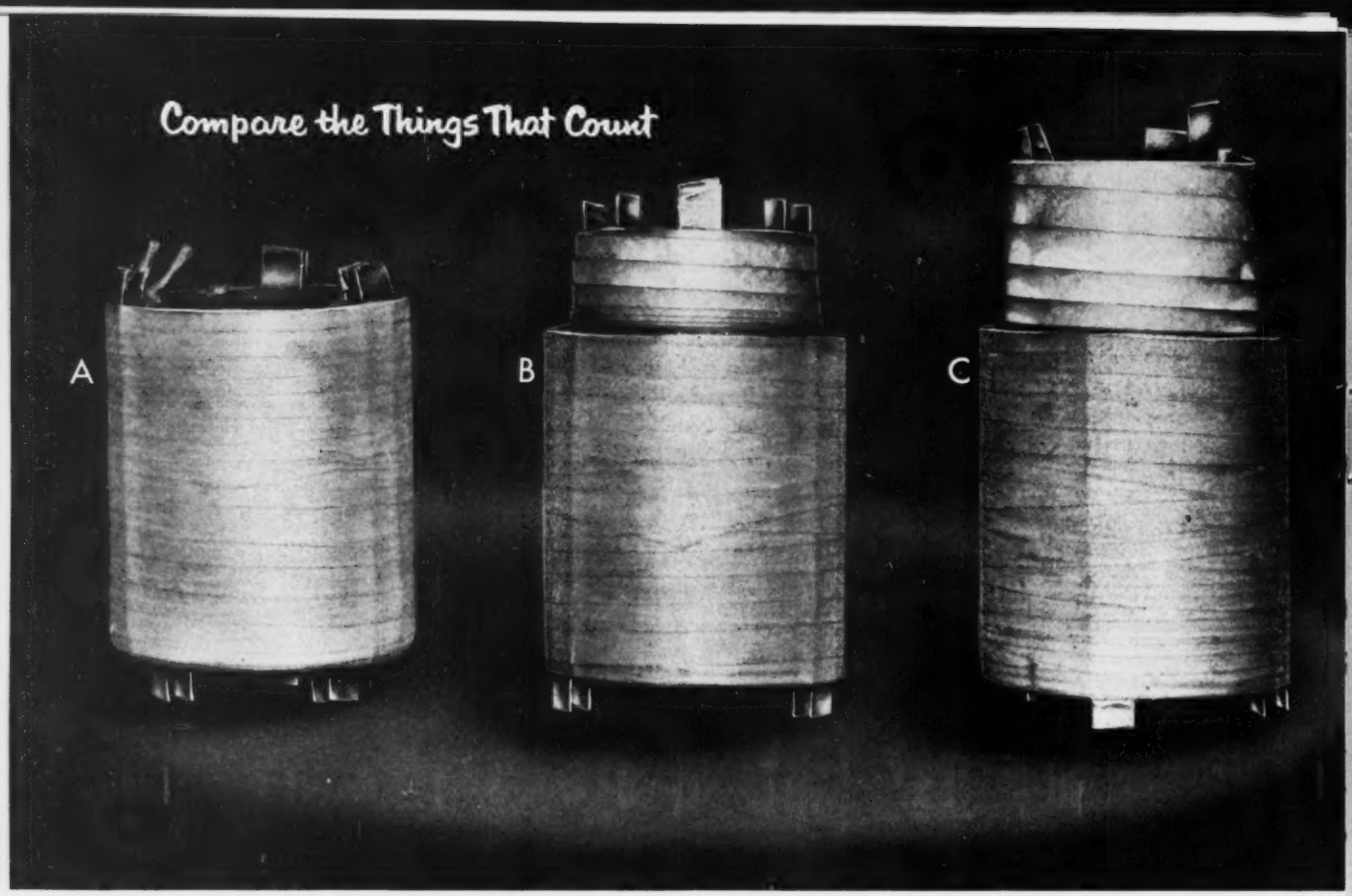


FIGURE 1: Results of the new shock test of varnish bonding strength. Coil A, impregnated with the best varnish, shows no separation. Coils B and C show too much separation, and the varnishes were rejected. For comparison, a coil whose insulation paper is brushed with shellac during winding will be torn almost completely apart, and an unimpregnated coil will be entirely separated.

FIGURE 2: Impregnated coil prepared for the shock test. Steel straps around the inner coil are fastened to the yoke at the top; straps around the outer coil are fastened to the bottom yoke. Coils will be violently jerked in opposite directions.

"Round-Wound" is a Line Material Company trademark

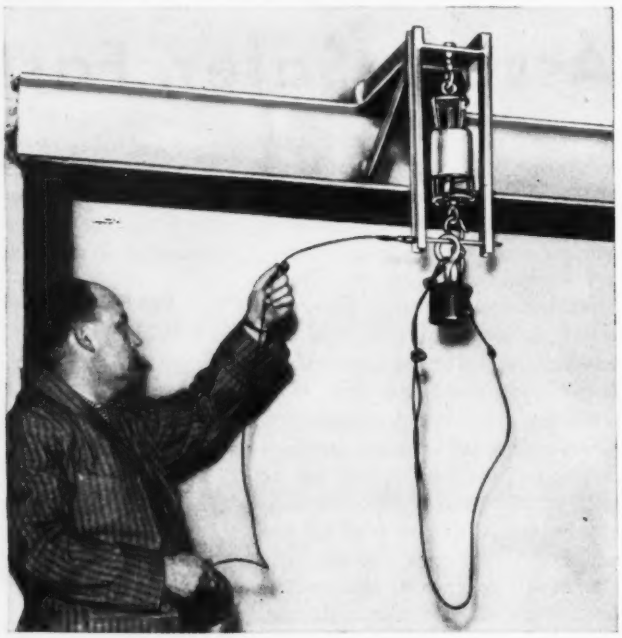


FIGURE 3: Shock test equipment. The top yoke is hung from a rigid support. A 10-pound weight attached to the bottom yoke by a steel cable is dropped 7 feet, resulting in an impact shock of 212 pound-feet per second. The amount of separation of the high voltage from the low voltage winding after one impact determines bonding strength of the varnish being tested.

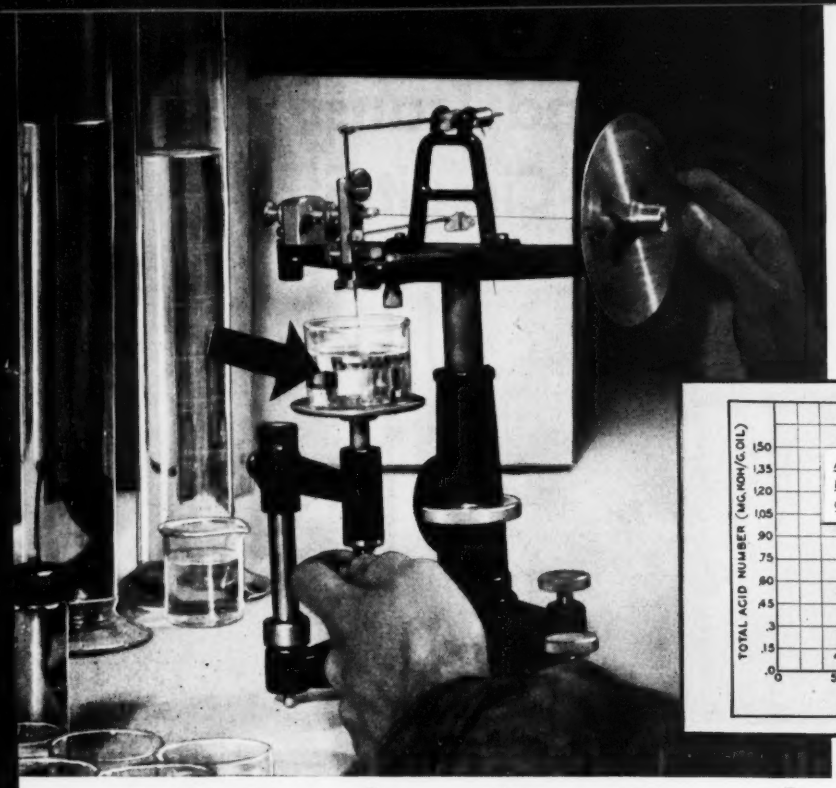
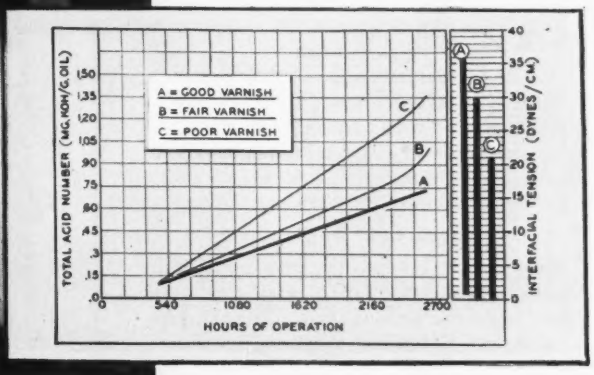


FIGURE 4: Interfacial tension tests of transformer oil (arrow), before and after cured varnish samples have been baked in the oil, are accurate predeterminations of the long-term resistance of the varnish to the oil.

FIGURE 5: Curves show long-term oil acid number for three different varnishes; bars show comparative short-term interfacial tension of the same varnishes.



L-M Develops New Varnish Tests To Assure Stronger Coils In Round-Wound Transformers

In addition to bonding strength, varnish requirements include low curing temperatures and freedom from contamination of or by the oil.

by **MARTIN I. ZWELLING**
Chief Laboratory Engineer
Transformer Division
Line Material Company

The primary, if not the single, reason for varnish impregnation of transformer coils is to resist short-circuit mechanical shocks. Under abnormal currents, windings tend to fly apart radially, and coils try to separate axially. In addition to strong blocking and clamping, good varnish impregnation is a substantial aid in resisting these forces.

But the problem is to get the right varnishes. Some varnishes will tend to dissolve in oil and thus lose their bonding strength. Others may appear not to dissolve but may actually contaminate the oil in long-term service and cause it to deteriorate more rapidly.

Curing must be complete, throughout the entire mass of the varnish and the coil. Some varnishes require curing temperatures so high that the life of the cellulose insulation is seriously reduced. Some varnishes simply do not possess the inherent bonding strength needed to resist short-circuit shock.

Recommended New Procedures

One drawback to selecting varnishes which meet all the requirements has been the lack of adequate tests for determination of varnish characteristics. Therefore we have developed new procedures to give us the necessary information.

One test (Fig. 4) provides a measure of the short-term resistance of varnish to transformer oil. Another measures the long-term resistance. Correlation between the two tests is very high. Compare the long-term rise in acids to short-term interfacial-tension test results in Fig. 5.

Bonding Strength Test

A new test was developed for varnish bonding strength (Figs. 1, 2, and 3). This test endeavors to pull sample coils apart by mechanical shock. An unimpregnated coil will be torn completely apart. Only the very best varnish completely resists separation.

Correlated With Service Conditions

Tests have been checked and closely correlated with actual service conditions, by comparing the condition of the oil and the resistance to short circuit of actual transformers impregnated with the various grades of varnish, with the laboratory tests of the same varnishes.

Benefits To Transformer Users

As a result of the program, we have been able to secure varnishes that have better resistance to oil, greater bonding strength, and lower curing temperatures so that there is less effect on cellulose insulation. Excellent characteristics of normal properties, such as dielectric strength, are also obtained.

All of these activities are part of a broad L-M engineering program that has been markedly successful in providing, in L-M Round-Wound transformers, the most desirable performance characteristics, with the added benefits of low operating costs and exceptionally long life.

Get The Whole Story On Round-Wound Transformers

Get the facts on the outstanding characteristics, the "Balanced Performance" of L-M Round-Wound Transformers. *Compare the things that count!* Ask the L-M Field Engineer for Bulletins and information; or write Line Material Company, Transformer Division, Zanesville, Ohio (a McGraw Electric Company Division).

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LM® LINE MATERIAL Transformers

Why L-M Round-Wound Transformers Have Such High Short-Circuit Strength

by **JAMES G. EVERHART**
Chief Engineer
Transformer Division
Line Material Company

One of the desirable characteristics of L-M Round-Wound transformers is their exceptionally high short-circuit strength. Partly this is inherent in the way we wind round coils on a wound core. But further, this strength arises from the exceptionally good mechanical design.

Effects of Short Circuits

Short circuits exert two forces—radial and axial. Under radial forces, rectangular coils tend to assume a round shape. Being already round, the coils on Round-Wound transformers resist these radial forces much better than do rectangular coils. (Figs. 1 and 2).

Axial forces tend to telescope the windings. Although failure is progressive, it can occur almost instantaneously. If the coil starts to telescope, the electrical centers of the coils are abnormally displaced. This results in a greater axial component which increases the force and the movement, leading to complete failure. (Figs. 3 and 4).

In larger transformers the mechanical forces involved can amount to thousands of pounds. Therefore in Round-Wound transformers we pay special attention to providing a mechanical structure sufficiently strong to support and hold the coils in position in the assembly.

This structure requires a rigid steel frame, firmly tied together vertically (Fig. 5), and properly designed blocking (Fig. 6). Even leads must be strongly clamped (Fig. 7), since great mechanical forces may exist between adjacent leads.

Varnish Selection

Correct application of the proper varnish provides a bond between layers of insulating paper and coil sections which contributes to short-circuit strength. We have developed a variety of tests for varnish, including a mechanical test of bonding strength. (Fig. 8). These tests enable us to select those few varnishes which combine the highest mechanical and electrical strength with other desirable qualifications.

The overall result of design, construction, selection of materials, and careful manufacture has given L-M Round-Wounds unusually high short-circuit strength, which contributes to an extremely low rate of failure.

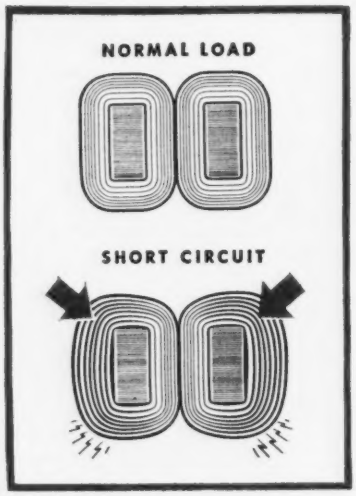


FIG. 1. Radial forces existing under short-circuit currents make rectangular coils tend to become round. The forces may be violent enough to damage insulation, or may completely destroy the coils.

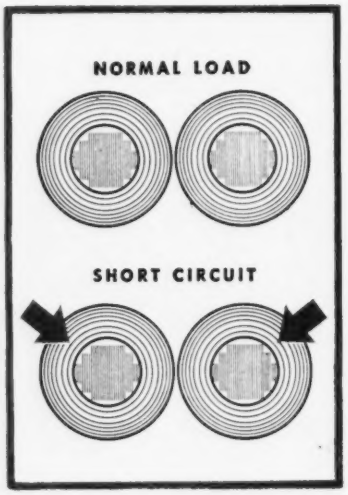


FIG. 2. Since the coils of Round-Wound transformers are already round, short-circuit radial forces cause no distortion. Thus Round-Wounds have inherently higher short-circuit strength.

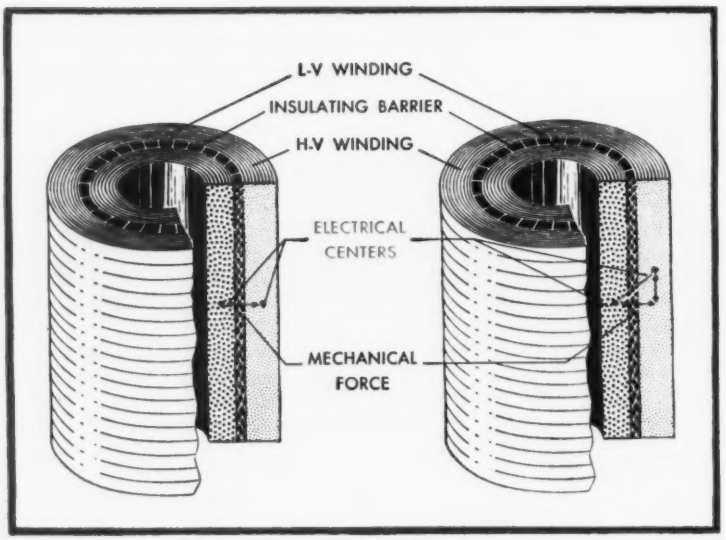


FIG. 3. Diagrammatic vertical section of coil showing primary and secondary electrical centers on the same horizontal plane. Under short circuits, all forces are radial and windings tend to repel each other in a horizontal plane. But even though coils can be designed with the electrical centers on the same plane, manufacturing tolerances cause some variations; and tap changer operations will cause some unbalance.

FIG. 4. With electrical centers displaced vertically, the force between the centers has both radial and axial (vertical) components. Axial forces cause the windings to telescope and separate vertically. Any displacement increases the vertical force component between them, which progressively compounds to complete destruction of the coils. The rigid construction of Round-Wound transformers prevents the slightest movement.

LINE MATERIAL Transformers

Compare the Things That Count

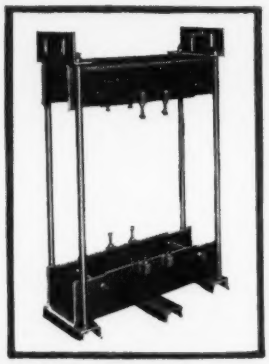


FIG. 5. Heavy steel frame provides a rugged mechanical structure that is firmly tied together vertically. It is sufficiently strong to support and hold coils in position in the assembly.

FIG. 6. Sturdy kiln-dried, oil-impregnated, shaped maple blocks give maximum contact and support to coil-edge surfaces. These are assembled and clamped so that they cannot move out of position under short-circuit forces.

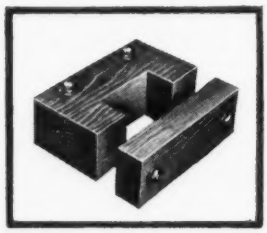


FIG. 7. Under short-circuit conditions, great mechanical forces exist between adjacent leads—especially in large transformers. These leads are strongly clamped so they cannot be harmfully displaced.

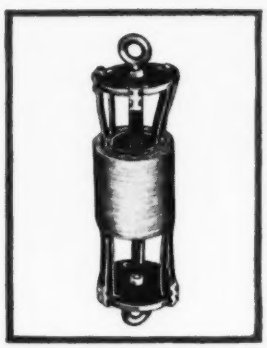


FIG. 8. Here is a coil impregnated with a test varnish set up for a pull test—which will determine whether the varnish has adequate bonding strength. This is just one of the tests L-M has developed to select the best varnishes for Round-Wound transformers.

"Round-Wound" is a Line Material Company trademark

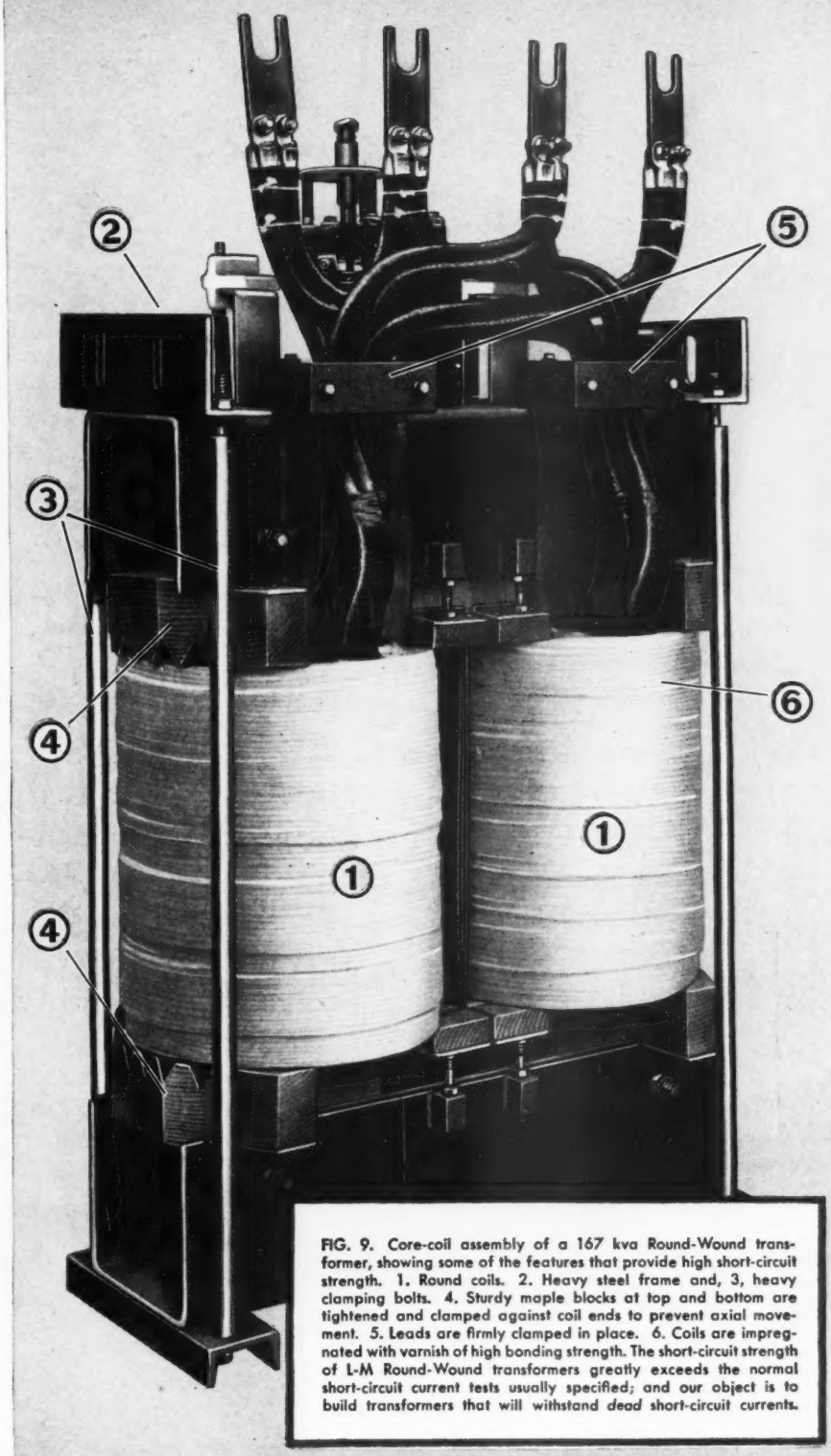


FIG. 9. Core-coil assembly of a 167 kva Round-Wound transformer, showing some of the features that provide high short-circuit strength. 1. Round coils. 2. Heavy steel frame and, 3, heavy clamping bolts. 4. Sturdy maple blocks at top and bottom are tightened and clamped against coil ends to prevent axial movement. 5. Leads are firmly clamped in place. 6. Coils are impregnated with varnish of high bonding strength. The short-circuit strength of L-M Round-Wound transformers greatly exceeds the normal short-circuit current tests usually specified; and our object is to build transformers that will withstand *dead* short-circuit currents.

Get Complete Information About L-M Round-Wound Transformers

We'd appreciate an opportunity to give you full information about the many desirable characteristics of these outstanding transformers. We'd like you to compare them with others—"Compare the things that count!" Ask the L-M Field Engineer for information; or write for new Bulletin DT-1 to Line Material Co., Transformer Div., Zanesville, Ohio (a McGraw Electric Company Division).

KERITE
CABLE-GRAM
THE ULTIMATE PROOF OF QUALITY IS IN THE CONTINUING TEST OF TIME. FOR ALMOST ONE HUNDRED YEARS THE QUALITY OF KERITE INSULATED CABLE HAS BEEN DEMONSTRATED BY LONG DEPENDABLE SERVICE LIFE UNDER THE MOST SEVERE CONDITIONS. KERITE'S ACCEPTANCE IS GREATEST WITH THOSE WHO HAVE USED IT LONGEST.
THE VALUE AND SERVICE LIFE OF A PRODUCT CAN BE NO GREATER THAN THE INTEGRITY AND CRAFTSMANSHIP OF ITS MAKER.

KERITE CABLE

THE KERITE COMPANY—30 Church St., New York 7, N. Y.
Offices also at 122 S. Michigan Ave., Chicago; 582 Market St., San Francisco;
3901 San Fernando Rd., Glendale 4, Calif.; 31 St. James Avenue, Boston

Inadequate Wiring—A Sore Spot Gets Sorer

It's beginning to look as though the whole electrical industry will soon have to concern itself with the problem of adequate wiring. The time seems to be coming—perhaps sooner than later—when the necessity for sufficient wiring capacity in homes and in commercial and industrial buildings to handle growing loads can no longer be shrugged off.

And it has been, is being, shrugged off. It is generally regarded as a problem that can safely be left in the hands of a comparatively few devoted individuals whose efforts have always been hampered by insufficient funds and by chronic disinterest in the top echelons of the industry.

Here is a quotation from a recent letter sent by a New York City landlord to apartment house tenants:

" . . . . . the average air conditioning unit creates an overload on the existing wiring in the building so as to create a hazardous condition and give rise to a constant threat of fire with resultant injury to persons and possible loss of life.

"Therefore we cannot and will not permit any air conditioning units to be installed in the apartment in which you reside.

"If you have already made such installation, you are hereby directed to remove same forthwith."

This is not a single instance. It is typical of many such notifications to apartment dwellers in New York, and probably in other cities, too. In a number of large apartment developments in New York, built in the last decade, room air conditioners are banned because of lack of wiring capacity.

The air conditioner is not alone as it inflames the sore spot of inadequate wiring. It is joined by the many portable cooking devices—broilers, roasters, casseroles, coffee makers, fryers, etc.—that are rapidly enlarging their space in the appliance field. These devices, which can be characterized as heavy-duty electric housewares because of their requirements of up to 1,500w or more, are doing their not inconsiderable share in making the sore spot sorer.

It is apropos to repeat here that apothegm we have used before: "No wiring, no business; some wiring, some business; more wiring, more business." If the electrical industry—manufacturers, distributors, dealers, utilities, contractors—want more business, then it is their responsibility to see to it that users' premises have more wiring. It's as simple as that.

It Hasn't Been a Bad Summer

As all summers must, that of 1953 is coming to a close. Again arises the perpetual argument, was it or was it not hotter than the summer of 1907 (or was it 1909?) when someone somewhere first fried an egg on a sidewalk? Actually in measurements of temperature and humidity it doesn't matter. Modern electrical living has done much to eliminate the differences in living conditions which once marked our yearly seasons.

The drudgery of housework must have made the summer of 1907 (or was it 1909?) feel a lot hotter than it really was. On the other hand modern appliances may have counteracted much of the heat of the past summer. Which is true really doesn't matter. The important thing is that today modern electric living is within the financial range of practically every American. Appliances are cheap, and electricity is only a few cents an hour.

But for the electric companies which have provided these low rates, there is still another job to do. They started this one years ago, but it is doubtful if it ever will be finished. The job is selling the customers on the cheapness of electricity and the many amenities of life it will provide.

Many companies are doing excellent work in this field at present. We can cite four in particular because they have just received the Reddy Kilowatt Advertising Awards. To these four, Washington Water Power Co, Central Hudson Gas & Electric Corp, Georgia Power Co, and Cleveland Electric Illuminating Co, we would like to add all other electric companies. There is no better way to aid the industry and our country than to promote modern electric living made possible by the low electric rates charged by the nation's utilities.

Regulation at the Crossroads

The electric utility industry may well ponder the recent Eighth Circuit Court decision in the case of Northern Natural Gas Co. on an appeal from an order of the Federal Power Commission (See story in this issue).

Of the ten points under review the court sustained the company only on the rate of return which the FPC had set at 5½%. In remanding the matter to the commission the court laid stress not so much on the obvious inadequacy of the rate of return, which was dismissed rather summarily in one sentence, but on the fact that the commission, in arriving at its decision, disregarded the testimony of its own witness, did not meet its own standards which it had prescribed in other cases or the standards of the United States Supreme Court.

In other words, the commission did not pass upon all those factors entering into the rate of return which it had considered in the Panhandle, Hope, and Canadian River Gas Co. cases. It merely considered some of the statistical measures of comparative yields of seven other gas companies.

What the court said in effect was that there is a difference between cost of money and rate of return. It is the latter which the commission is required to determine, with a full disclosure of the bases for its findings.

This finding by the court is to be applauded. Yet we cannot overlook the fact that in some of the past decisions, both of the FPC and other commissions, where all legal standards were seemingly met and where all the factors entering into the rate of return were considered, no weight or probative value was given to any of them.

A notable exception to the above precedure was the recent decision of the Illinois Commerce Commission in the case of the Peoples Gas Light & Coke Co. Here the commission, mindful of the State Supreme Court's findings in the Illinois Bell Case, found a reasonable measure of fair value and rate of return for Peoples Gas.

The Eighth Circuit Court's ruling as to the inadequacy of the FPC's findings may mark the end of an era wherein regulatory hostility went hand-in-hand with the cost of money doctrine and its inevitable partner the net original cost rate base. There are signs, such as the Illinois and Maine (New England Telephone & Telegraph Co. vs Maine Public Utilities Commission before the State of Maine Supreme Judicial Court, Jan. 17, 1953) cases, that responsibility is returning to the regulatory benches and that the fundamental concepts of the Bluefield and United Railways cases are being implemented in a practical and honest manner.

It is to be sincerely hoped that the recent FPC's decision in the case of the United Fuel Gas Co., where 6¼% was allowed, indicates a recognition that higher rates of return are a must to attract expansion capital.

No Communists Wanted

The discovery of "an active Communist cell" in San Francisco Bay area public utilities (EW Aug. 24, p 104) should not come as a shock or surprise to the electric utility industry. For some strange reason one is likely to discover a Communist anywhere. There are even a few millionaires who support the Red movement.

But such a discovery should alert the entire industry to the dangers of Communist infiltration. The industry is too important to the nation's welfare to have on its payrolls those who believe that communism is a better way of life.

Pacific Gas & Electric Co. is to be complimented on its quick action at the news. It immediately told those named in a California Senate investigation to quit or be fired. There is no other way. On the staffs of all our power suppliers, no matter by whom they are owned or operated, there is room only for loyal Americans.

The Land of Opportunity

There is a land of opportunity awaiting the electric industry. It has been pointed out by the Gas Appliance Manufacturers Association in the pages of our daily newspapers. Proudly the association announces that since 1948 approximately 12.5 million domestic gas ranges, more than 10 million gas water heaters, and 14.8 million units of gas heating equipment have been shipped (and we can safely assume sold). This can mean but one thing. There are at least 10 million potential customers still to be sold on the advantages and convenience of the all-electric home.

This is a big market for today and for the future. The time to start developing that market is now before more people turn temporarily to gas at the expense not only of themselves but of the entire electric industry.

THE ELECTRICAL WEEK

The Issue's News Highlights—TVA claims its atom-plant record in supplying power to AEC at Paducah, Ky., is better than EEInc's . . . APPA requests investigation of ODM tax benefit certificate granted to Vepco for its Roanoke Rapids project.

Columbia River basin states disagree on how to step into any partnership role in water resources development . . . Personnel changes are reported by REA and BPA.

Edison Electric Institute reports new capacity has not been added at rate predicted earlier this year.

"No strike" pledge is approved by union officials representing 15 AFL crafts at EEInc's Joppa power plant in Illinois. Evan Dale, president of Southern Illinois District Council, says he could see no further "reasons for another work stoppage at Joppa." Bechtel Corp, new contractor at plant declares operations would begin "on a modest scale." Bechtel's statement continues: "We plan to accelerate operations as rapidly as possible after the starting date."

Knoxville, Tenn., City Council votes 5-to-2 to donate $1,000 to a public power lobby dedicated "to save the TVA." Councilman C. Walker, who fought against the appropriation, declared, "I think it's utterly ridiculous to give away the people's money for something that is not going to happen."

Electric bills are exempt from Pennsylvania's new general 1% sales tax which became effective Sept. 1 because such bills are subject to other state taxes. However sales of electric appliances are subject to the levy, whether sold by a utility, electrical appliance store, or other stores handling such merchandise.

Ontario Hydro-Electric Power Commission is preparing Hamilton's two steam plants for immediate service because of possibility of a power shortage in Ontario within the next few months.

Off the New England Wire—Central Maine Power and IBEW-AFL agree to 4% general wage increase plus another 1% special adjustment to preserve the wage relationship between job classifications previously agreed upon . . . Holyoke (Mass.) Gas and Electric Department increases pay for about 200 employees $5 per week, effective Aug. 31.

New England Telephone & Telegraph Co's refund to New Hampshire subscribers upholding PSC's decision on rates includes a 15% allowance for federal taxes on 15 months' bills. Interestingly, the cost of the rate case is being deducted from the rebate, reducing the refund by about 18.3%.

Pennsylvania PUC fixes Sept. 15 for final argument in Harrisburg on $1,169,000 a year rate hike proposal sought by Scranton Electric . . . Hearings on California-Oregon Power's application for $2,349,000 a year general rate increase in four Oregon counties, is postponed indefinitely by the Oregon PUC.

Off the Washington Wire—Shakeup at REA continues with creation of two new regional offices and downgrading for five area loan offices. All area directors have been replaced. Joseph O'Brien moves up to become chief of the newly created Electrical Engineering Division which will handle generation and transmission loans. Under the shakeup the following divisions have been abolished or replaced: Power, Operations, Engineering, Technical Standards, Controllers, and Power Analysis.

FPC has been requested to authorize Philadelphia Electric to absorb Southern Pennsylvania Power and Chester County L&P. Southern and Chester are subsidiaries of Philadelphia . . . California Oregon Power has received FPC approval to sell about 20 miles of transmission lines in Coos County to the federal government for $223,500.

Utilities serving the major cities showed a whopping increase in electric output, due primarily to the heat. This helped to push the national output to a record 8,539,557,000 kwhr for the week ended Aug. 29. This is a 11.7% increase over the same week last year.

Florida P&L and IBEW-AFL agree to 5½% wage increase retroactive to April 27.

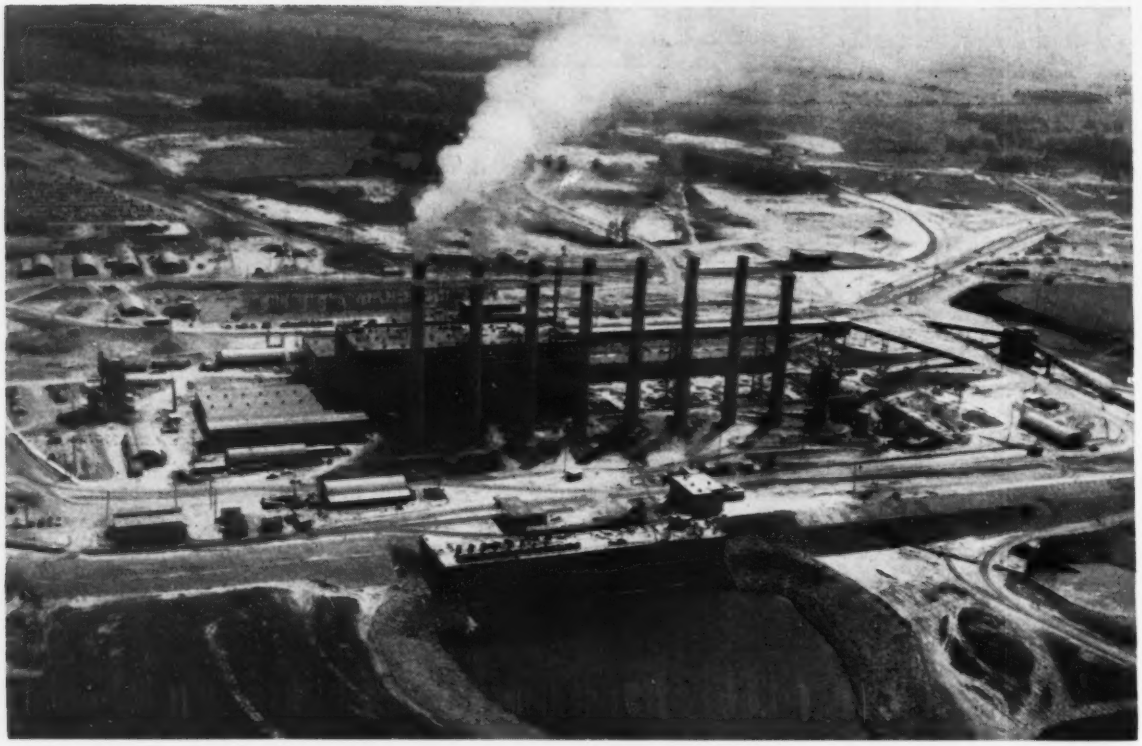
In Carolina P&L's service area 68% of the 250 schools with cafeterias have all-electric kitchens due to promotion efforts of the company's Commercial Sales Department. About 37% have electric water heating. Average cooking load per school is 35 kw.

Dublin, Ga., citizens vote 2,422 to 916 for J. Felton Pierce, a grocer, for mayor instead of re-electing Mayor W. H. Lovett who advocated that the city buy the Georgia Power Co's distribution system. Incumbent mayor had obtained some backing for city to go into public power and had started action for a city-wide vote on the issue.

Town of Petersburg, Alaska, plans to open bids next April for $750,000 hydro project, according to R. W. Beck & Associates, consulting engineers for the development . . . Subject to ratification by Anchorage voters Oct. 12, an agreement for sale of Little Eklutna hydro plant to federal government is signed by representatives of Interior Department and the Alaskan city.

Indiana & Michigan Electric signs 10-year contract with Fort Wayne, Ind., to supply the municipal light plant with electricity instead of the city's having to build a new steam plant. City utility engineers decided that an inter-connecting system would work to the "best advantage" of municipal light patrons.

Congratulations—General Electric elects Arthur Vinson vice president of manufacturing and general manager of company's Manufacturing Services Division in New York . . . TVA appoints Charles J. McCarthy solicitor, succeeding Thomas J. Griffin, deceased . . . Rockland L&P elects L. Earle Merrow vice president.



Shawnee Plant, shown above, supplies AEC at Paducah at $145 per kw, TVA asserts

TVA Claims Better A-Plant Record

Tennessee Valley Authority has taken the initiative in the "contest" with Electric Energy Inc in supplying power to the Paducah, Ky., plant of the Atomic Energy Commission.

TVA, while acknowledging that final estimates will not be available until EEInc's and TVA's plants are completed, said in a statement that facts now available show that its unit construction costs are lower and its rates more favorable to AEC and the nation's taxpayers than EEInc's. This statement was contained in an 18-page report just released by TVA.

The authority said data should be available shortly to determine actual costs of power to AEC on the basis of bills rendered by TVA and EEInc, a privately owned utility.

TVA and EEInc contracted with AEC in 1950 to construct separate steam plants to supply power to the atomic plant. Output of the TVA Shawnee plant is 300,000 kw and the EEInc Joppa, Ill., plant 322,000 kw. Each has two generating units.

Estimated Costs Compared . . . The report reveals that figures filed with the Securities and Exchange Commission show that the estimated cost of the Electric Energy plant of four original units has increased from $81 million in May, 1951, to $118,252,000 in June, 1953. Costs per kilowatt of capability for the plant have risen correspondingly from $126 to $184. The two additional units which are being built are estimated to cost even more, the latest figure being $63.9 million, or $198 per kw of capability.

A-Plant Comparisons

Plant	TVA Shawnee	EEI Joppa
No. of Units	10	6
Rate Capacity (Kw)	1,350,000	750,000*
Capability (Kw)	1,500,000	966,000
Cost of Plant	$216,500,000	$182,152,000
Estimated Cost per kw	$145.00**	$188.00**

*EEI has contracted to supply AEC with 735,000 kw as compared with 750,000 kw rated capacity.
**Based on Capability.

Total cost is estimated at $182,152,000, or about $188 per kw of the six-unit plant of 966,000 kw of capability.

In comparison the Shawnee plant of ten units is estimated to cost $216.5 million, or less than $145 per kw of capability. Capability of the Shawnee plant units is 150,000 kw each, or a total plant capability of 1.5 million kw.

As to speed of construction TVA said the first unit at Shawnee Plant was placed in commercial operation in April, 1953, about two years and three months from the time construction was started. The second Shawnee unit went into operation in June, 1953, several weeks before the first unit in the Joppa Plant was placed in operation.

Companies participating in the formation of EEInc included Central Illinois Public Service Co, Illinois Power Co, Kentucky Utilities Co, Middle South Utilities, Inc, and Union Electric Co of Missouri.

Atomic Study Teams Realigned

Members of three industrial power groups combine, admitting American G&E; sixth team applies to AEC

Three of the five industrial teams studying the feasibility of atomic power have completed a major realignment of their study groups. In addition, a sixth group new to the field has applied for government permission to initiate atomic power studies.

Both moves, of course, are subject to approval of Atomic Energy Commission. There seems little doubt, however, that AEC's okay will be more than a formality in either case.

Prospective new entrants in the field are Duquesne Light Co, Pittsburgh utility firm, and Walter Kidde Nuclear Laboratories, Inc.

Reshuffle of the veteran teams brought together the members of all three except Monsanto Chemical Co. Monsanto has asked AEC permission to go ahead with its atomic power work alone.

American G&E Joins Up . . . Monsanto's former partner, Union Electric Co of Missouri, has joined two other teams—Commonwealth Edison Co, and Pacific Gas & Electric Co-Bechtel Corp. This group also has been joined by the American Gas & Electric Co. Chairman is J. W. McAfee, president of Union Electric.

Public Service Co of Northern Illinois, formerly associated with Commonwealth Edison in its atomic studies, has merged with that company. Thus, Public Service personnel will continue to be available for cooperation with the new study group.

The new five-company group fits the pattern of mass corporate backing followed by two other study teams. Dow Chemical Co and Detroit Edison Co now are associated with 25 other firms in their feasibility studies. Pioneer Service & Engineering Co and Foster Wheeler Corp have the support of six utilities.

Withdraws Request . . . Commonwealth Edison, which had requested AEC authorization to build a power reactor—reportedly cooled by high-pressure water—has withdrawn this application, at least, for the present. This is to give Commonwealth Edison's new associates an opportunity to consider this and other types of reactors.

Monsanto repeatedly has discussed with AEC officials the construction of a reactor for the production of commercial electric power and plutonium for sale to the government. Monsanto's president, Charles A. Thomas, played a prominent role in inducing AEC to permit industrial teams to study atomic power some two years ago.

The Dow-Detroit Edison group already is conducting advanced studies of the feasibility of a breeder reactor. The Pioneer Service-Foster Wheeler team began its studies only a few months ago.

(For comparison with previous study group setup, see EW, Aug. 31, p 24).

New Capacity . . .

. . . has not been added at the rate predicted earlier this year, EEI survey committee reports

Estimates of capacity to be installed during 1953 have been cut from 11.6 million kw to about 9 million, but still the industry should be able to carry the predicted December peak of 82.8 million kw "satisfactorily". This is the opinion of Edison Electric Institute's Power Supply Committee, given in an interim survey revising its April estimate through July 1.

The report was sandwiched between the Thirteenth (April) and Fourteenth (October) Semi-Annual Surveys.

Short 850,000 Kw . . . The interim survey showed that 3.5 million kw of new generating capacity was placed in commercial operation the first six months of this year. Since April 1 an additional 850,000 kw has been rescheduled to 1954, leaving about 7.2 million kw still to be installed in the 1953 program. The committee, however, feels that new capacity brought into service the last six months "may not exceed 6 million kw."

"Although the material supply situation has now greatly improved," the report said, "accumulated difficulties resulting from earlier shortages and other problems may continue to cause substantial delays in the completion of new projects well into 1954."

Estimate Stands . . . On reviewing its figures, the committee found that peak loads estimated for December in the Thirteenth Survey would probably hold.

APPA Asks Probe . . .

. . . of ODM certificate granting write-off to Vepco on Roanoke Rapids project

A Congressional investigation of the granting of a tax benefit certificate to the Virginia Electric & Power Co for its Roanoke Rapids hydroelectric project has been asked by Alex Radin, general manager of the American Public Power Association. The Office of Defense Mobilization authorized the certificate late last month in the interest of a general defense program.

According to Radin it "will permit the company to write off, for tax purposes 65% of $33,095,000 worth of power facilities over a five-year period instead of a period of 50 years or more normally followed in depreciation of such facilities."

Radin pointed out that the purpose of the tax certificates is to give financial incentive to companies to build projects or speed up construction of facilities which are necessary to the defense effort. He emphasized that in the Roanoke Rapids case, the company applied for a Federal Power Commission license for the project almost two years before the beginning of the Korean War and has contended that the project is a necessity and would be needed to supply the company's normal peacetime demands.

The APPA leader also quoted from FPC decisions before and after the Korean War to the effect that the company would require no federal participation or appropriation, and that the company had adequate financial ability to undertake and complete the project.

Jack G. Holtzclaw, president of Vepco, said he would delay comment until appraised of the full text of the APPA protest.

Northwest Seeks Hydro Pact

Columbia Basin states far from agreement on local partnership plan to dovetail with federal power policy

Columbia River basin states—where hydropower potential and demand accentuate conflicts dealt with by the new federal power policy—are a long way from agreement on how they might step into any partnership role in the development of water resources.

Speaking before the Columbia Basin Interagency Committee in Butte, Mont. last month, Gov Len Jordan of Idaho called for creation of a special committee to set up project priorities and allocation of land use in the region. The next day in Salem, Ore., members of that state's Interstate Cooperative Commission moved to formulate a proposed compact for study by other members of the six-state Columbia Interstate Compact Commission session in Yakima, Wash. on Sept. 11.

Coming within a few days of pronouncements by Undersecretary of the Interior Ralph Tudor emphasizing need for "local interests" to fill the key role in supplying the nation's electricity supply, these appear to be prompt expressions of willingness to share the burden of Columbia basin resources development.

Local Problem . . . Tudor, in an interview extending the earlier policy declaration, stated in answer to questions by The Portland Oregonian that Interior hasn't given much thought to how the partnership will work in the Pacific Northwest, that initiative must come from local groups. Tudor mentioned the interstate compact proposal and possibly new emphasis on the interagency committee with more leadership by the governors and less by federal agencies. But Tudor made it clear that the problem is one for the Pacific Northwest to solve.

Beneath each proposal advanced so far are hidden differences illustrated by the fact that the compact commission is still in doubt whether it should embrace the question of hydropower in any program of water resources development. This question was the major topic of debate in a member forum as recently as June and highlight of the July meeting at Hungry Horse, Mont. There, State Sen Lloyd L. Wallace, Polsom, Mont., argued Montana legislature's authorization for state membership in the Columbia compact specifies such activity shall deal with both power and water allocations.

Rep. Carl H. Francis, of Dayton, Ore., laid before the July session a flat assertion that the Oregon members believe allocation of water should be the only consideration of any regional compact.

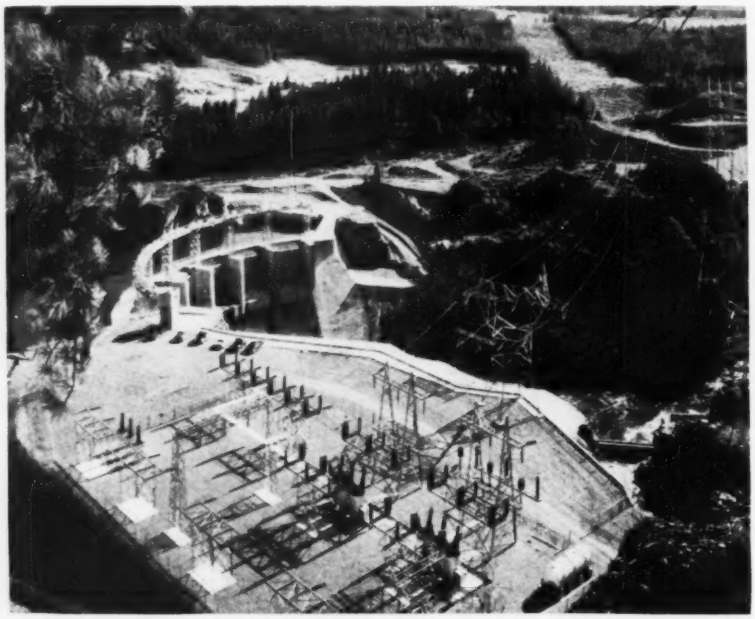
Organization Formed . . . After some two years in which the group of Pacific Northwest states have mulled over what direction their compact might take, representatives of six states meeting in Portland in the June session effected what amounts to the first formal organization.

They elected a slate of officers, picked Spokane, Wash., as headquarters and moved to hire an executive secretary and staff.

President is Frank Banks, Grand Coulee, Wash., retired Bureau of Reclamation engineer who helped build the vast multipurpose dam near where he now resides.

Other officers: Les Colby, Missoula, Mont., vice president; Mark Kulp, Idaho reclamation engineer, secretary-treasurer. Supporting finances of $40,000 come from six states: Oregon, Idaho, and Washington, $11,000 each; Montana, $5,000; and Wyoming and Nevada, $1,000.

Contrasts in programming views by the respective states were aired in that organizational session in Portland. Speakers for the panel discussion on the question of whether hydropower should be added to the scope of activity also debated the related ques-



Cabinet Gorge Dam Completed

Washington Water Power Co has turned on the fourth and final 50,000 kw generator at its $46 million Cabinet Gorge Dam, which is located on the Clark Fork River of Idaho. Southward over the switchyard are two lines leading (left) to an intertie with Bonneville Power Administration's Spokane-Warm Springs (Montana) line, and (right) to Spokane. Both are 230,000 kv lines. Powerhouse lies below the switchyard on the same side of the river. First generator was put on line in September, 1952, second in November, and third in February, 1953. Cabinet Gorge has a rated capacity of 200,000 kw and a capability of 230,000 kw.

tion of whether the commission should become an operating agency and issue revenue bonds for multipurpose project construction.

They also touched on aspects of sports and commercial fishing interests; payments from power dams, private or local public agency for navigation; flood control and irrigation; payments in lieu of taxes; priority claims on water by farmers and municipalities; compatibility of policy with codes of the respective states and federal government relating to rivers and water use; allocation of power to the member states, whether the commission would be advisory or operative; whether any power projects —if power is included—would be single purpose or multipurpose structures; whether power would be subsidized or subsidize other benefits.

Caution Urged . . . Then last month members of the Oregon Co-operation Commission heard advice from Frederick L. Zimmerman, Hunter College, New York City, and research director for the Interstate Cooperative Commission of New York, cautioning against any attempt to deal with specific problems. He said flatly that it would be difficult to obtain agreement from the states on the many difficult issues involved in their proposed compact.

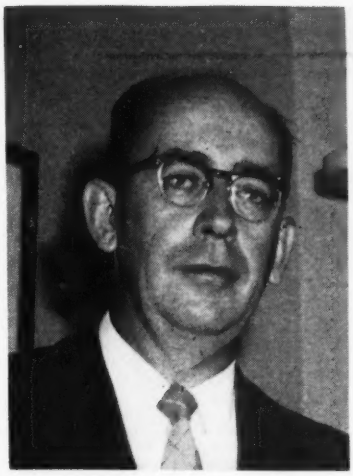
He recommended instead providing machinery for resolving issues as they arise.

While the Oregon group shunned premature hint of the direction of their compact proposals, there were indications the plan would run somewhere along the line of Zimmerman's suggestions.

This would contrast with others to be presented at the September session where some member states are expected to seek specific action more in line with an active partnership—perhaps leadership—role in power development.

In the last analysis, any regional agency proposal must not only survive initial compromises among member state commissioners but then win legislative endorsement of respective states and also the sanction of Congress.

There is a growing body of opinion in the region that such an agency working with a comprehensive basin development plan must somehow be established to meet the challenge laid out in Washington.



ROY G. ZOOK

Shakeup Spreads . . .

. . . in personnel of REA, Bureau of Reclamation, and Bonneville Power Administration

Personnel changes have been coming thick and fast in the Rural Electrification Administration and agencies of the Department of Interior.

Top developments have been the appointment of Roy G. Zook as acting assistant administrator in charge of REA's electrification program, and the abolishment by Interior Secretary Douglas McKay of the job held by Kenneth W. Markwell as assistant commissioner in charge of design and construction for the Bureau of Reclamation.

The latter move left Harvey F. McPhail as the only remaining Bureau assistant commissioner, since McKay also announced reduction of Goodrich W. Lineweaver from assistant commissioner in charge of programs and finance to the status of an assistant to the commissioner. In other moves:

- REA Administrator Ancher Nelsen announced that in the interest of efficiency and economy, certain activities were being discontinued, curtailed, or transferred to borrowers. This meant dismissal of 37 of REA's 1,059 employees, and reassignment of 11 others to lower grade positions.
- Bonneville Power Administration notified 109 employees that their jobs will be terminated within 30 days, bringing total reduction in staff since last November to 549.

Zook comes to his new post after serving 14 months as director of REA's western area.

States Exempted . . .

. . . from two requirements of Federal Power Act concerning public hydro projects

Two minor amendments to the Federal Power Act will relieve states and municipalities of certain requirements in connection with publicly operated hydroelectric projects.

Effect of the changes, signed into law by President Eisenhower, is to exempt states and cities from:

- Provisions of Sec. 14, of the Federal Power Act, which establishes a formula under which the acquisition price of the licensed project can be determined in the event it is acquired by the federal government at the end of the license period.
- Keeping accounting records and depreciation rates in connection with the rate jurisdiction of the Federal Power Commission.

Helps Bond Sales . . . In approving these amendments, the Senate Public Works Committee said removal of the acquisition formula provision would assist states and municipalities in sale of bonds for financing such projects. It noted that the provision would not affect the right of the federal government to acquire a project by normal condemnation, and upon payment of just compensation, when advisable in an emergency.

As for the rate accounting requirements, the committee pointed out FPC has no jurisdiction over power rates charged by such public bodies. Hence, it said there appears to be no reason for such accounting requirements. A third proposed amendment, which would have exempted states and municipalities from annual charges in connection with FPC regulation of licensed projects, was dropped by the Senate committee.

Budget Bureau Backing . . . The new amendments had the backing of the Budget Bureau, FPC and Interior Department. The three agencies opposed the annual charge amendment on the grounds that it was discriminatory and would prevent FPC from administering its licensing authority on a self-sustaining basis. The new amendments do not apply to St. Lawrence Power Project for which FPC granted a license to Power Authority of the State of New York.

"My electric bill is the best argument I know for private enterprise"
"In recent years there has been a lot of discussion as to private power versus government ownership. I am not in favor of government ownership of anything.
"I notice our bill this month was $8.32. Now I am going to surprise you. This isn't a complaining letter but a complimentary letter. My wife and I were talking over the services we received for this $8.32. We have an electric range, a good size deep freeze, two refrigerators, four radios, two carpet sweepers, a cool staker, a hot water heater, dishwasher, electric disposal sink, automatic clotheswasher, electric air filter, and in my work shop I have an electric drill, electric drill press, electric turning lathe, large size band saw, 10" circular saw and a 6" planer. We use an electric heater and electric fan at irregular intervals.
"We really marvel at the great number of services we enjoy and when we think of the number of them, we marvel at the low price we pay."
Electricity Is the Biggest Bargain in the Home!
This is typical of letters received by the Company . . . AND . . . facts and figures PROVE they are right. The average cost of electricity served to W.W.P. residential customers is only 1.20¢ a kilowatt hour, while the national average is 2.71¢; and the average for PUDs, despite their easy tax burden, according to latest data is 1.28¢.
The Washington Water Power Co.

WASHINGTON WATER POWER took first in Reddy Kilowatt Advertising Contest with a series of which this ad was one. See opposite page

Reddy Kilowatt Awards to 4 Utilities

Washington Water Power places first in competition for best series of advertisements dramatizing low cost business-managed electricity. Central Hudson first for single ad entry

Washington Water Power Co and Central Hudson Gas & Electric Corp have been adjudged the winners of the first Reddy Kilowatt Advertising Award. WWP, with headquarters at Spokane, took the series award for four advertisements run in April and May of this year. Central Hudson, with headquarters at Poughkeepsie, took the single advertisement award for its entry published April 7.

Honorable mention in the series contest went to Georgia Power Co. In the single entry contest it went to Cleveland Electric Illuminating Co. Thus each of the four winning companies represents a different area of the country. Fourteen companies entered single ads, and 13 entered the series competition. Twenty companies competed.

Contest judges were Col. H. S. Bennion, managing director, Edison Electric Institute; Fischer S. Black, editor, Electrical World; Ed Dunning, N. W. Ayer & Son, New York; Stephen Fitzgerald, Stephen Fitzgerald Co, New York; and Donald D. Hoover, Bozell & Jacobs, New York.

As advertising manager of Washington Water Power, Randall A. Johnson received a certificate and $250. Vernon Shepherd, advertising manager of Central Hudson, received $150 and a certificate. Honorable mention went to Joseph W. Kling, Georgia Power, and Robert H. Bridges, Cleveland Electric Illuminating.

The purpose of the contest was to find the best possible newspaper advertising using Reddy Kilowatt to dramatize for the mass public the story of low cost business-managed electricity. Such advertising would be of value to the private companies in offsetting "cheap" government electricity propaganda.

Contestants were allowed to use the negative approach in copy; that is, deride the claims made by public power advocates. But all of the winning ads used the positive approach; that is, they played up the advantages of using their electric service or the low price at which it is sold.

The contest was unusual in these respects. It was the first industry contest requiring that all ads submitted be based on the same theme. It also was the first to award prizes directly to the advertising manager instead of to his company.

some wives!

The Farmer Takes ~~a Wife~~

The good old days, eh? Not for the farmer's wife! Go through an old family bible, or some early church records, and see just how common it was for great-grandpappy to work several wives into an untimely grave. He wasn't necessarily mean; but the combination of endless backbreaking drudgery, poor medical and sanitary conditions, plus raising a large family, was all too often more than the average woman could stand. That's why Samanthy "went into a decline"! "Killing work" wasn't just a figure of speech in those days.

But look around you now. Sure, the farmer's wife still leads a busy life. As do all housewives. But where has the backbreaking drudgery gone? Most every woman who keeps house has the equivalent of six and a half servants working for her — servants who work for small wages.

Who cleans the house, lights the lamps, washes the clothes, refrigerates the food, performs easily, cheaply and quickly the thousand-and-one odd tasks that carried so many of our ancestors to a premature grave? Why, Reddy Kilowatt, of course!

It's electricity that enables you to do twice as much as grandma, do it better, and do it with time to spare . . . spare time to sit down and be entertained at the radio or TV by the same servant who lightened your toil during the working day.

Who made this possible? Not government! Just the good old *American* system of business enterprise — companies like Central Hudson who have kept the price of electricity at rock bottom; the appliance manufacturers who developed the equipment which stands in your home.

"WHAT ELECTRICITY MEANS TO ME IN MY HOME"

A Contest open to any home user of Central Hudson Electricity

Many Electrical Prizes — Clothes Dryer, Sewing Machine, Band Saw, Vacuum Cleaner, Food Mixer — You may win one!

Get full information at any Company office

©RK

CENTRAL HUDSON GAS & ELECTRIC CORPORATION

BEST SINGLE ADVERTISEMENT in Reddy Kilowatt Contest submitted by Central Hudson G&E

NW Power Contract Revised

To overcome earlier protests from industry and public power agencies, the Department of Interior has rewritten its proposed 20-year contract with private power companies.

"I think there will be no major objections to this version," said Paul J. Raver, administrator of the Bonneville Power Administration, in announcing the plan in which three key points were revised.

Chief change is in the controversial Section 6, which would have stopped public power agencies from adding any new or expanded industrial service requiring more than 10,000 kw a year from BPA. New version prevents public and private agencies alike from adding 10,000-kw customers.

Shortage of Power . . . Raver asserted since there wasn't enough power to go around Interior Secretary Douglas McKay had decided that householders and small power users should be taken care of first. He said that big expansion in the Northwest would have to wait until Congress approves many more dams.

Two other main objections have been covered by the new proposal. In one, a clause was inserted that none of the earlier rights of public power agencies would be abrogated. In the other, a proposal that costs of steam generation be shared by all Bonneville customers was eliminated.

The new plan would replace five-year contracts. Private power firms had objected that they were limited to these terms, while industries and public power agencies had contracts running up to 20 years.

Copies of the new plan, which still has to be approved by McKay, have been sent to all concerned, and they have until Sept. 10 to make their replies. The proposal has been dated tentatively to go into effect Sept. 15.

McNary Flow . . .

. . . is scheduled for Dec. 1, when Units 1 and 2 will go on line in Northwest Power Pool

A new Northwest construction schedule is designed to put initial generators of the McNary Dam project on the Columbia River into service in the Northwest Power Pool network Dec. 1.

On that date ceremonies will kick-on Units No. 1 and 2, largest hydrogenerators in the world, each capable of 70,000 kw and counted in federal capacity increments that should preclude for several years any major regional power shortage such as plagued the Pool last winter.

To Close Locks . . . The Corps of Engineers originally had scheduled the construction items for July-August but a tardy Columbia runoff peak plus river shipping interests' request for delays in closing McNary's locks postponed the work. Col F. S. Tandy, Walla Walla district engineer in charge of the $300 million multipurpose structure's progress, set the new schedule to begin Aug. 31. That day locks were closed for two months while upstream navigation channel sill blocks are being raised to 320-ft level.

The final phase will begin Nov. 1 when the Corps, electrical equipment suppliers and installers and contractor engineers will cooperate in test runs of the generators. By then McNary's reservoir should stretch some 60 mi. up the valley of the Columbia impounding almost the total 1 million-acre ft of water from which 14 generators will put 980,000 kw into the Bonneville Power Administration's transmission network.

An 11-Mile Pipe Cable Completes 132-Kv Loop

E. T. CARMICHAEL and **T. E. STARRS,** Engineers, Public Service Electric & Gas Co, Newark, N. J.

A new 185,000-kva capacity pipe-type cable now links Athenia and Bergen switching stations of Public Service Electric & Gas Co, forming a new loop and improving reliability of service in the company's northern territory. Other sides of the loop are two two-circuit steel tower lines from each switching station to Kearny station.

In 11 miles this new 132-kv underground transmission line runs through 10 municipalities, goes under 7 railroads, is hung from 7 bridges and lies on 3 river beds. Thus it avoids above-ground right-of-way difficulties through residential territory. However the pipe installation and conductor pulling-in operations presented problems that taxed the ingenuity of the engineers and construction crews. How some of those problems were solved is illustrated on these pages.

RAILROAD CROSSING here is a 16-in. dia steel casing driven under tracks and extending 40 ft on each side. Space between casing and pipe was filled with sand. Later cable was pulled in

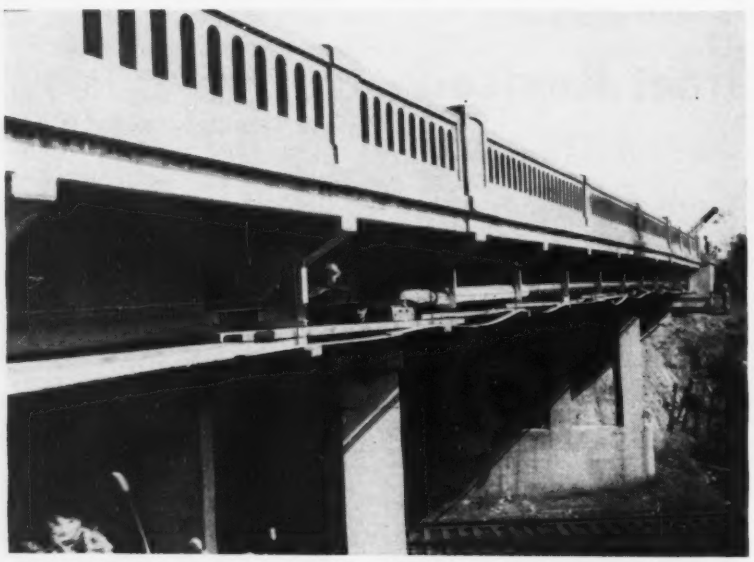
Buried Section

Full length of the cable is housed in steel pipe 8.125 in. ID, 8.625 in. OD and weighing 22.3 lb/ft. It was received in 40 and 50 ft lengths, had flared ends for welding with chill-rings.

Pipe corrosion protection is provided by Somastic covering ½ in. thick and weighing 13 lb/ft. Weight of pipe and covering is 35.3 lb/ft.

Manholes total 27. Each has a 6 ft by 16 ft area and is poured concrete with two 36 in. cast-iron frames and covers. They are spaced at 2,000 to 3,000 ft intervals.

Blind joints—sleeves without splices—were installed near potheads. With a pothead failure, only the faulted conductor need be cut and spliced.



UNDER A BRIDGE on a highway and over a railroad, the 8-in. pipe was pulled aided by rollers, then rested on the hangers. Later an asbestos sunshade was installed over the pipe

HIGHWAY CROSSING required a tunnel. After laying pipe, tunnel was backfilled

ON EAST BANK of Passaic River 50-ft concrete covered pipe was welded into 200-ft sections. Steel drums were attached for buoyancy

WATER'S EDGE VIEW shows one pipe section (left) with attachments, in runway with rollers, ready for 1,000-ft river crossing

AN LST WINCH provided pulling power on west bank of river. Pipe pulling was guided by instructions over portable telephone sets

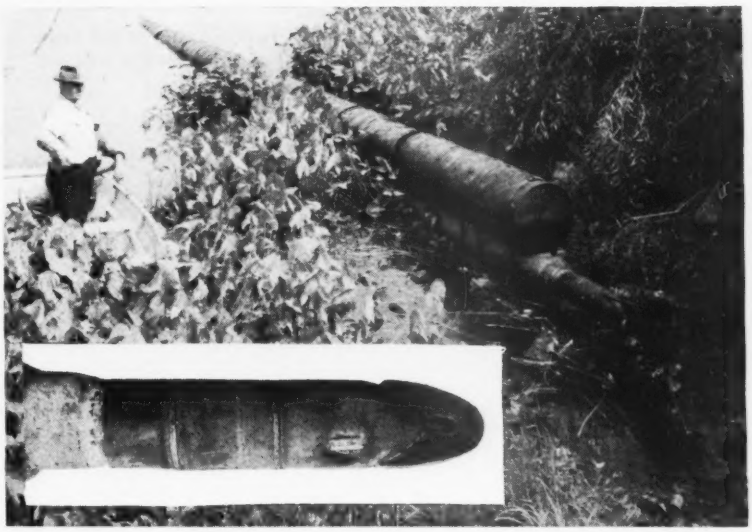
River Crossings

A 1,000-ft section of the 132-kv line crosses on the bottom of Dundee Lake in the Passaic River.

For the underwater crossing, delivered pipe was welded into sections which were tie-welded as the pipe was pulled across the river. All welds were tested at 500 psi, coated with corrosion resistant compound and a metal jacket attached for protection.

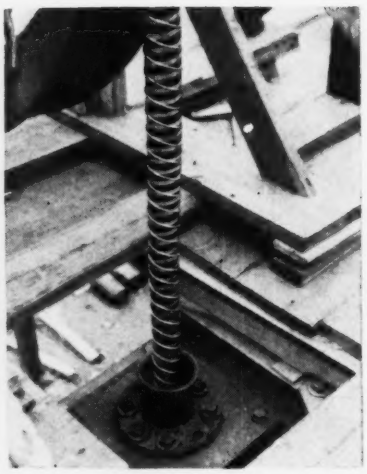
Over the Somastic coating further protection was provided with 1.5 in. reinforced concrete. Total weight is 110 lb per ft, providing 10 lb negative buoyancy in silt of 1.9 specific gravity.

Steel drums reduced dragging on the river bottom during the pull. Drums were released when the pipe was positioned.

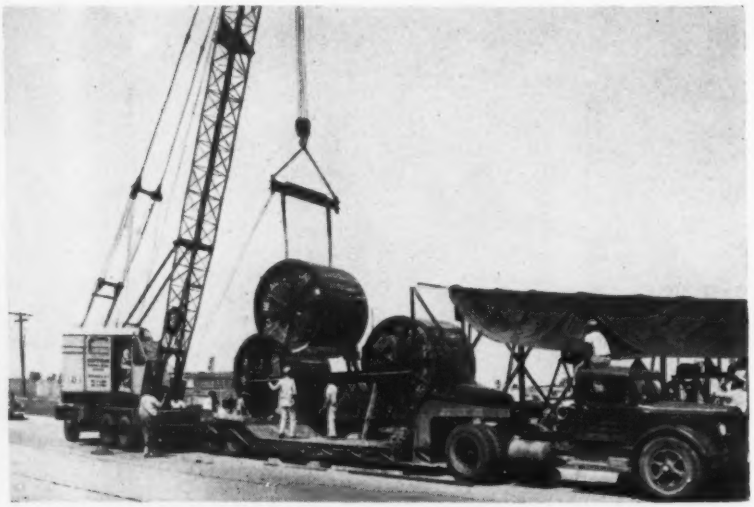


APPROACHING WEST BANK the crossing was made in 2 days by 200-ft pulls and butt welding additional 200-ft sections. Close-up view is pulling head welded to pipe

OVER SHEAVES the 1,250,000 cir mil cables were pulled into risers and down to spreader-head type terminals at both the Bergen and Athenia switching stations



CABLE ENTERS riser from sheave. Skid wires and copper shielding have opposite lay



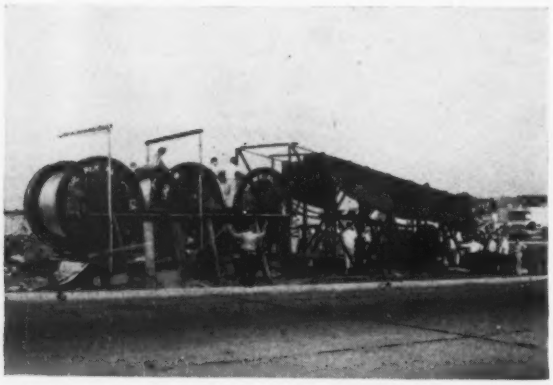
CABLE REELS, weighing as much as 11 tons each, were transported on low-bed trailer and placed on racks for cable pulling-in operation. 120,000 gal of oil were used to fill pipe

Cable Pulling

Three 1,250 cir mil segmental conductor cables were pulled simultaneously into the 8-in. pipe. At the Athenia and Bergen terminals and at various manholes along the line, reels of cable were delivered on low-bed trailers and mounted on a rack. Longest pull was 3,100 ft and pulling stresses were 2.5 to 4.5 lb/ft of pull.

One of the three conductors is equipped with two 0.100 in. by 0.200 in. copper skid wires with 3-in. lay, the others with only one. This construction is used for a carrier current channel for relay operation.

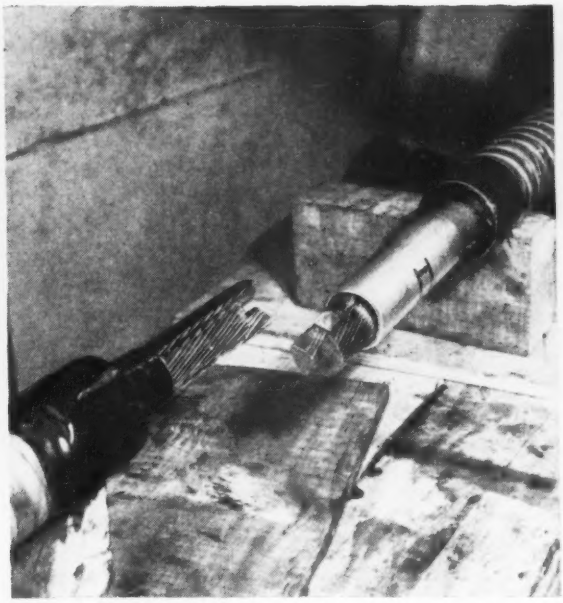
After the cable was pulled into the pipe, the line was filled with 120,000 gal of oil. Two 6,000-gal tanks at the ends provide for expansion.



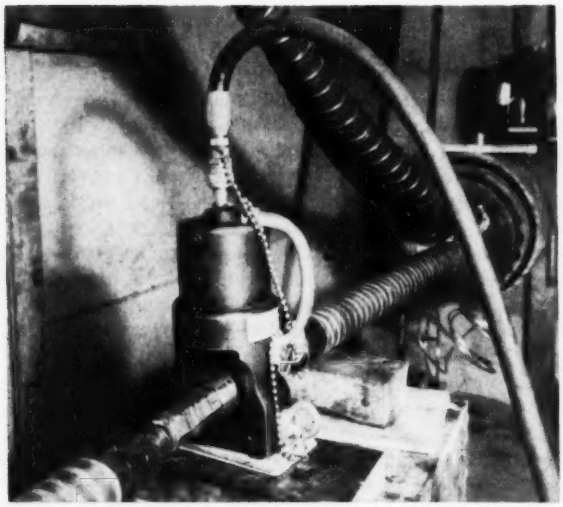
CABLE PULLING SET-UP along a main highway. Each reel has single conductor cable and three cables are pulled simultaneously into pipe

PULLING RIG or winch pulled cable from reels through pipe to manhole at end of rib. Longest pull was 3,100 ft, shortest about 1,150 ft

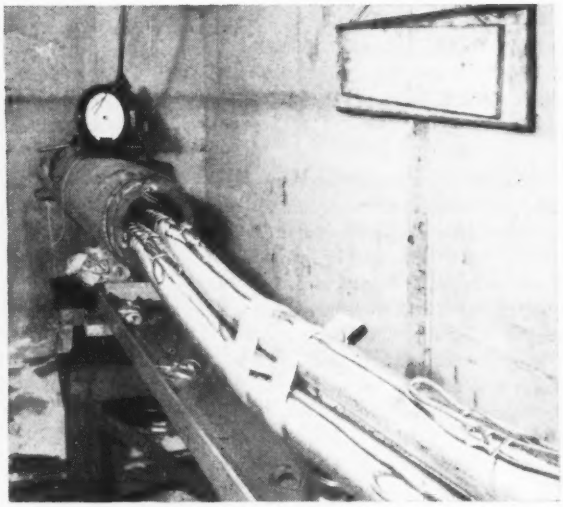
"NIGHT CAPS" protect ends of pulled-in cable until ready to splice in the manhole. Cap is held by J-bolts and kept under nitrogen pressure



SEGMENTAL CONDUCTOR is used in each cable. Segments are staggered for joints. Sleeve connector was slipped on far conductor



SLEEVE CONNECTOR and conductor ends were compressed by a 40-ton press with hexagonal die and then a round die



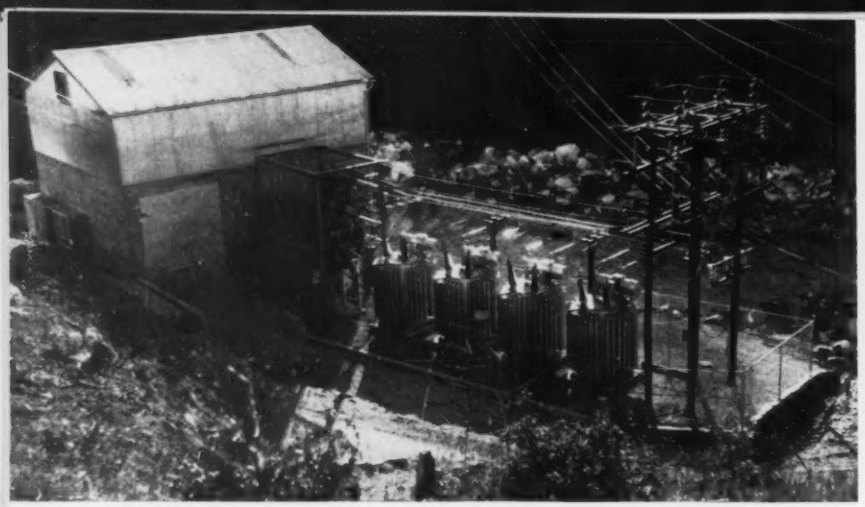
CONDUCTOR SPLICES are completed and steel sleeve will join pipe ends. Temperature and humidity were controlled in each manhole

Splicing Operation

Cable splicing was done in temperature and humidity-controlled manholes. Segments of each conductor were staggered-cut, butted and enclosed in a hydraulic type compression connector, with final increase in diameter of only 0.1 in. This splice was insulated to 150% cable diameter with 0.003 in. crepe paper, shielded with copper braid. Splice was encased in 12-in. pipe sleeve welded to reducing flanges on the pipe ends; over-all length is 84 in. Splices were made in 60 to 72 hrs plus 6 hrs for welding.

Cable insulation consists of 0.505 in. of paper. Cable in river sections equipped with polyethylene jacket for protection against possible water concentration at these low points.

Pipe has no stop joints, is filled with oil at 200 psi. Oil pressure is maintained by dual pumps at both ends of the pipe.



POWERHOUSES are kept small with only enough spare room inside building to permit removal and storage of rotor. House pictured is 30 by 38 ft and contains 7500-kva vertical water wheel generator with associated switchboards. The switching structures are adjacent

ROCK-FILL DAMS are low cost and can be constructed on foundations unsuitable for concrete structures. Picture shows partially

Small Hydro Sites Can Be

Recent advances in design of dams, electrical controls and appurtenances have reduced construction and operating costs so that many small stream projects are now economically feasible

H. H. GNUSE, Jr, Vice President, Nantahala Power & Light Co, Franklin, N. C.

Utility managements today may find it profitable to take another look at the economics of developing hydro power in their areas, particularly from relatively small streams. Although no incentive other than economic feasibility should be necessary, there are several additional advantages and benefits to be derived from developing small hydro sites.

Rural Load Areas . . . Often the sites will provide a source of power near rural load areas. Such locations will usually be very helpful to the operating personnel during periods of system disturbances and for carrying local load during scheduled and emergency transmission, distribution line, or substation work. For the design engineer, the existence of a reliable hydro site in a particular area will often allow him to effect economies in the design of supply substations by considering the hydro as an emergency source of power.

Adapted from recent Southeastern Electric Exchange paper

Natural Resources . . . Such projects utilize otherwise valueless natural resources, thereby conserving the country's supply of fuel. This type of development is always welcomed by state utility and conservation commissions and, consequently, is a good political asset. Another benefit that cannot be evaluated in material terms is the improved public relations and good will created when the lakes are filled and opened to the public for boating and fishing.

Electrical Advancements . . . The most important electrical development that has produced economy in hydroelectric operation is the improvement of supervisory control and telemetering equipment, which has greatly reduced the number of operating personnel required, or eliminated the need entirely. The application of this equipment to substation control is familiar to most utility engineers. Details of its use in hydro generation are quite similar. However, in order to keep the design simple and the cost to a minimum, care and judgment should be exercised to prevent installing any more of this type of equipment than is basically necessary.

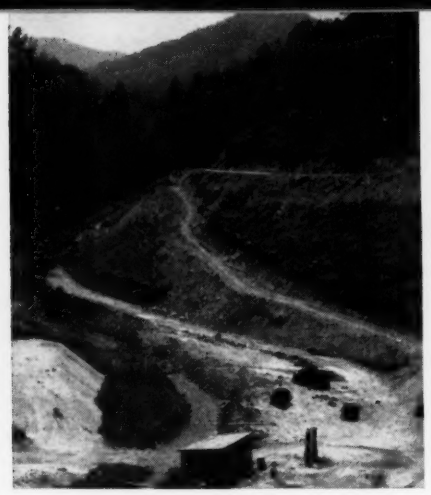
Some companies still prefer to synchronize their plants manually by telemetering the relative phase angles between the generator and the system. Actually, there are automatic devices on the market that perform the synchronizing function with far more consistent accuracy than human operators. Using this, supervisory control needs only to initiate a master starting relay that will bring the machine up to speed, place it on the line, and then turn it over to the remote dispatcher for adjustment of load. If desired, even the amount of load can be preset and the machine brought up to this load without any assistance from the dispatcher.

Supervisory Control . . . Recent installations of the Nantahala Power & Light Co have utilized supervisory control to:

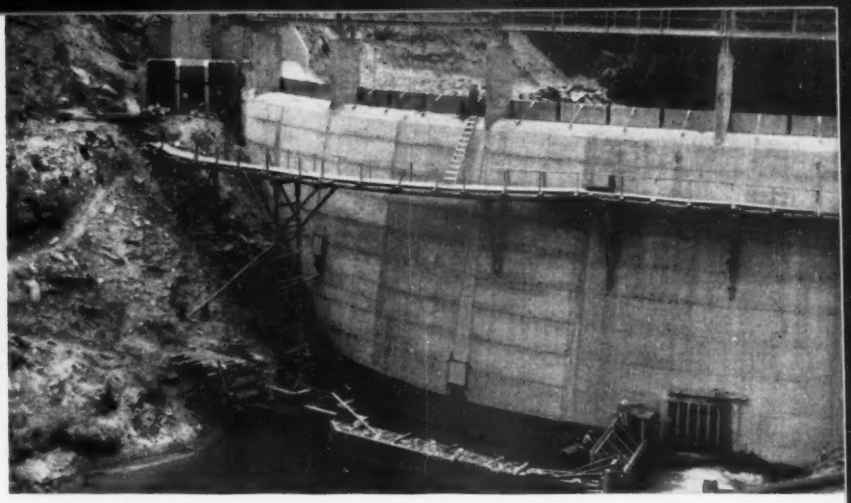
1. Start and stop the unit.
2. Adjust kilowatt load on unit.
3. Adjust reactive kva on unit.
4. Open and close air break switch (for line sectionalizing at some plants).
5. Alarm for operation of automatic relays.
6. Alarm for high and low lake level.

Telemetering is used only to:

1. Indicate generator kilowatt output.
2. Indicate generator reactive output.
3. Indicate generator voltage.
4. Indicate lake level.



completed rock-fill, earth-faced dam which will be 78 ft above lowest foundation excavation. Note stream size in right foreground



CONCRETE ARCH DAM (upstream face) with intake structure at left end of dam. Note collapsible type of flashboards on crest of arch dam. Concrete dams can only be justified at locations that lend themselves perfectly by a thin section arch dam

Developed Economically

With the proper design of plant and supervisory and automatic control, in most cases no regular attendants are required. The company's practice is to have one man service several plants, performing such functions as lubrication, clean-up, and simple routine inspection and tests.

Annunciator Circuits . . . Another point of caution is in regard to the annunciator circuits which are provided between the hydro plant and the dispatching plant. There are a number of operations that could take place at the plant which would automatically shut the machine down and lock it out so that it cannot be restarted from the dispatching point. Each of these devices could be equipped to operate a separate alarm and annunciator point at the dispatching office, but this is an unnecessary luxury. One annunciation indicating that this lockout relay has been operated is all that is necessary in view of the fact that a man must go to the plant in any case before the unit can be restarted.

Another annunciator point could logically be used for those relays that shut the machine down momentarily but following which the machine can be restarted from a remote point. Another simplification and economy is the use of float-operated taintor gate controls, which automatically adjust the taintor gate to the proper opening when the lake is full to pass the stream flow above the discharge of the turbine unit. This eliminates a supervisory point for remote operation of the gate and a telemetering point or two for indication of the gate position.

Mechanical Advancements . . . The application of corrosion-resistant steel to critical areas of water turbines has greatly reduced the maintenance costs of these units. The company has one 60,000-hp turbine operating under 1,000-ft head that shows negligible cavitation and erosion effects since stainless steel was applied seven years ago; whereas, originally extensive repairs were required after only three years' operation.

The installation cost of steel pipe has been greatly reduced by utilizing in the design the inherent self-supporting strength of the pipe. When pipe is to be put underground, another cost-saving technique of installation is use of methods developed by the pipe line companies.

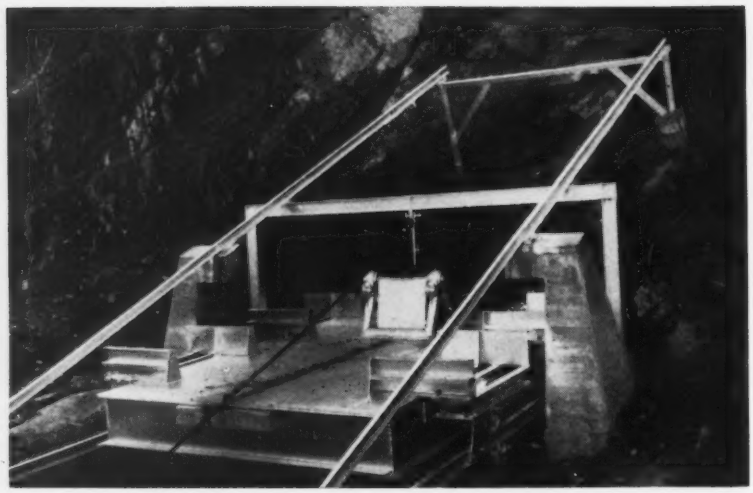
Filling valves can be built into the face of an intake gate so that the tunnel or pipe line can be filled to equalize the pressure before the gate is operated. Such an arrangement saves the cost of providing a separate bypass valve and piping.

Rock-Fill Dam . . . The development of the rock-fill dam has probably been the greatest factor in reducing construction costs of small hydro projects. On small streams where the flood flows can be passed around the dam through low saddles in adjoining hills or through spillway and cascade sections cut into the rock abutments at the ends of the dam, the rock-fill type construction proves very economical. In many cases it costs less than one-third of a concrete structure.

Basic Data On Five Projects Constructed Since 1948

	Queens Creek	Tuckasegee	Cedar Cliff	Bear Creek	Tennessee Creek
Size of Unit—kva	1800	3300	7500	10,000	12,000
Avg Net Head on Unit—ft	929	117	169	224	486
Avg Annual Gen.—Mwhr	5000	13,200	24,300	32,000	38,200
Drainage Area—sq mi	3.6	54.7	80.7	75.3	40.1
Type of Dam	Rock-fill, earth-faced	Concrete arch	Rock-fill, earth-faced	Rock-fill, earth-faced	Rock-fill, earth-faced
Height of Dam—ft	78	61	165	215	180 and 140
Cost per installed kw	$310	$300	$220	$300	$365*

* This project also provides down-river benefits to existing plants



INTAKE GATE, specially designed, with filler valve built into face of gate. This saves cost of providing a separate bypass valve and piping. Gate is located in storage position on gate track

The reason for the reduced cost is fundamental. Rock can be quarried from the spillway and cascade areas and placed in the dam for about $1.50 per cu yd. Concrete would cost about $20 per cu yd, depending on the availability of cement and suitable concrete aggregate. Thus, per cubic yard rock-fill costs less than one-twelfth that of concrete. Since the rock-fill requires only about four times as much yardage as a gravity concrete dam, the economy of the rock fill dam is obvious. Company studies indicate that concrete can be justified only at locations that lend themselves perfectly to a thin section arch dam. Even in such cases, the rock fill would usually be competitive.

Advantages of Rock-Fill . . . There are many additional advantages that the rock-fill dam possesses:

1. It can be constructed on foundations completely unsuitable for concrete structures. Unit loads are much lower and foundation conditions less critical. This permits a wider choice of site and a reduction of foundation treatment.

2. The rock-fill dam of the earth-faced type is practically immune to damage by earthquakes or sabotage. The elasticity of the impervious clay fill makes it self-healing and it actually tightens and improves with age. Leakage is therefore held to a minimum.

3. Its construction does not require much equipment other than the road-building type and requires very little high cost, expert supervision, control, and inspection, which means that more contractors are qualified to perform the work. Design costs are also less than for concrete structures.

4. Its material is practically always available at the site. The quality of rock is not critical because the design can be modified to use most any type of rock and earth that is available.

5. Loads and stresses in the dam and foundation are low and free from abrupt changes.

6. Danger from uplift is eliminated by the free draining rock-fill.

Hydraulic Design Savings . . . Additional savings in the construction cost can be accomplished by laying out the diversion tunnel so that it can later serve to deliver water from the lake to the powerhouse after the construction is completed. Costs can also be reduced by designing controlled spillway structures, such as taintor gates for flows of say 25-year flood magnitude, with relatively inexpensive washout type fuse plugs for larger, less frequent flows. Before the fuse plugs would be washed out, the flood flow would have reached such a magnitude that the additional discharge from the lake storage through the fuse plugs would not contribute excessively to the flood peaks downstream.

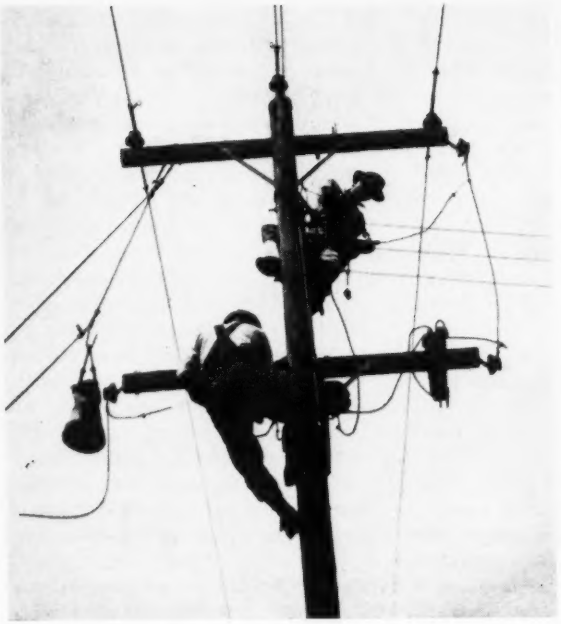
Recent Developments . . . By taking advantage of all the design economies previously mentioned, Nantahala Power has been able to design five small projects since 1947 which were considered economically feasible. On the theory that the primary consideration in determining whether a project should be built is the long-term cost per kilowatt hour without regard to the size of the installation, these plants have ranged in capacity from 1,800 to 12,000 kva. Three of these projects are now in operation, and two are under construction.

Remote Controlled . . . All of these plants are remote-controlled from previously existing attended plants. Two of the new plants that are located within 5,000 ft of existing attended plants are controlled by 19-conductor control cable with the generator busses extending directly to the attended plants where the generator breakers are located and synchronizing is performed. This is the simplest, cheapest, and most satisfactory arrangement for remote control. The other three plants are located from 3 to 10 miles from the controlling station and are controlled by either pilot wire or carrier current supervisory control with the necessary telemetering.

The size of the powerhouses has been kept small, with only enough spare room inside the building to permit removal and storage of the rotor. For instance, the plan dimensions for a powerhouse that contains a 7,500-kva unit is only 30 by 38 ft. As no regular operators are in attendance at the plants, no separate office or control room has been considered necessary.

All the dams but one have been of the rock-fill, earth-faced type. This particular earth-faced type construction has been developed by the Hydraulic Department of the Aluminum Co of America under the direction of J. P. Growdon, who is now hydraulic consultant for the company. Seepage past these dams has been negligible, being only 3 to 5 cfm past the Nantahala Dam, which is 250-ft high. A 165-ft high dam recently constructed with a very minimum of supervision or of laboratory control over the placement of the earth fill has a seepage and percolation of only 5 cfm.

Construction of these projects has convinced the company that the day of hydroelectric development has not passed. Even though the government may pre-empt construction at the larger sites, there still remains economical hydroelectric potential in many of the smaller streams which are more commonly available.



LINEMEN removing arrester and cutout while reconnecting transformer during a conversion. The cooperation and alertness of each workman has been important factor in conversions

GROUP LEADERS and foremen being briefed by director (the author with long bill cap) just before going to work. Detailed briefing and thorough work preparation are keys to success of conversions

How Georgia Power Co Goes About—

Organizing a Voltage Change Over

Fifteen years of experience have helped develop procedures so successful that not a single motor has run backward nor has one lamp burned out

A. R. PERDUE, Division Engineer, Georgia Power Co, Rome, Georgia

There are three keys to the success of Georgia Power Co procedures for conversion to higher distribution voltages. They are: (1) thorough work preparation, (2) full responsibility and authority by an installation director, and (3) detailed briefing of all group leaders and crews. Each man's cooperation and alertness on his individual assignment also has been a contributing factor.

Here is how company crews have helped municipalities and their crews to convert their distribution systems from 2400-v delta to 4160-v wye:

Adapted from Southeastern Electric Exchange Paper

Field Check . . . As the line crew begins to work, a field check is made of every phase corner and every transformer phase connection of the primary circuit. For this a map of the system is a "must." It should cover the single-phase lines completely. Georgia Power maps record vertical turns, and note the position of each conductor on the poles. This makes it possible to designate as a phase wire a conductor that is in top position on the pole.

Sometimes, it may be necessary to roll the vertical turn to make the phase wire take top position on the pole. Since on the company system the common neutral takes the neutral position, we always make sure that a former phase wire converted to a neutral is in the neutral or lower position on vertical turn poles.

At each three-phase bank a sketch is made, on a "Ditto" skeleton form, of the physical layout of transformer risers and connections, as seen from the ground at the rear of the transformers looking toward the high-voltage bushings. "As Found" connections are shown with black pencil. Red markings show the simplest possible changes to convert the bank to wye.

The accompanying illustrations show how these field notes are made. It is assumed that the lineman is only equipped with a pair of pliers and makes the minimum number of operations necessary for the change. Wherever possible, one side of each transformer is left undisturbed.

Field sketches like these eliminate physical conflicts such as crossed jumpers or jumpers from one side of the pole to the other. They also show what has been done to provide a

means of "commoning" one side of each transformer.

In most cases the normal delta tie between the two outside transformers is the ideal means of common connections. It is only necessary to isolate it from other connections. At the same time the transformer secondary connections are drawn on the sheet for any possible future reference.

Phase Designations . . . Although the field check is not the place for phase designations, practice is to indicate the direction of the source on the three-phase bank sketches, making it possible to determine phase designations later in the office.

On platform structures, a plan drawing is made of the pole and transformer layout. Some open-delta banks require a swap of transformer riser connections to primary at the top of the pole. Swapping offers a means of clearing up a physical hazard of facilitating the use of the best two out of three transformer risers.

Sometimes, one primary out of three on a tap line may be converted to a neutral, thus requiring reconnection of the open-delta bank at the end to wye operation. Both high-and low-side connections must be changed. These reconnections are always made on the lighting transformer to eliminate any possibility of putting high voltage on the lights.

Before leaving the site, one more drawing is made: A diagram of the substation connections from the high side at the station frame through to the low side leaving the station frame.

Phasing . . . Back at the office, the phasing of the transmission line is determined tracing it through the substation to the distribution line leaving the station. This phasing is then indicated at each phase corner on the primary map made in the field. Phasing is also indicated on the sketches of the transformer bank connections.

Crews always try to leave one side of each transformer connected to a phase that it is already on. The cutover is much easier if bank phasing remains undisturbed. Single-phase kva balance does the job without involving a complete rearrangement of connections on the banks.

The new transformer and phase corner connections are put on a one-line diagram. It shows all the changes in connections, conversion points, and autotransformer or step-down transformer connections.

Making Ready . . . Meanwhile, the line crew should have strung all the neutral wire and completed other construction work. The crew foreman then gets a copy of the one line diagram and his crew proceeds to make ready for the cutover.

They start at a corner, at a point in the line beyond which no neutral is strung but where one of the primaries is to be converted to a neutral. They extend the neutral, in the form of a ground wire, up the pole and out the arm to the phase to be converted, leaving enough wire coiled up to make connections. The same procedure is followed at each transformer installation beyond this conversion point. On platform structures and wherever necessary, the bus for the transformer common is installed in advance.

If the conversion is to a voltage requiring differently-rated transformers, the crew hangs a new transformer on the pole. Sometimes they lower the existing transformer to a temporary position and hang the new transformer in the correct position.

Cutting Over . . . The number of operations involved in cutting over is the sum total of the number of single phase transformers, conversion points, and three-phase banks to be worked on. Three methods can be used to make the cutover:

(A) If the system is in range of a 600-kva station, the complete cutover is made on a three-hour or less interruption, working on a weekday afternoon or Sunday afternoon.

(B) If the system is in range of a 600 to 1500-kva station, the cutover is made in one day, catching single phase transformers in the morning and three-phase banks in the afternoon.

(C) If the system is above a 1500-kva station, cutover is made in two days, usually Saturday and Sunday.

Number of Crews . . . The number of operations and the method to be used determine the number of crews. Our standard crew comprises a foreman, two journeymen linemen, one apprentice lineman and two helpers, plus a line truck. Most company districts have a three-man crew consisting of a journeyman, apprentice, and helper, with a one-ton truck.

Help needed is based on a complement of three men and a truck handling four operations per hour. The number of crews of this size is determined by dividing the number of operations by four times the number of hours available for "on the job" work. Each of the crews gets a copy of the one line diagram with their assigned area marked out for them in color.

The assigned area is made the responsibility of the group leader. He is drafted from the ranks of district engineers, field engineers, and estimators within the division. The group leader checks print errors and for any transformers that might be on the line and not shown on the print. His responsibility extends up to the first transformer in adjacent areas. The group leader does not attempt to tell the man on the pole *how* to do his work. In our opinion, this is the main *key* to the success of the procedure.

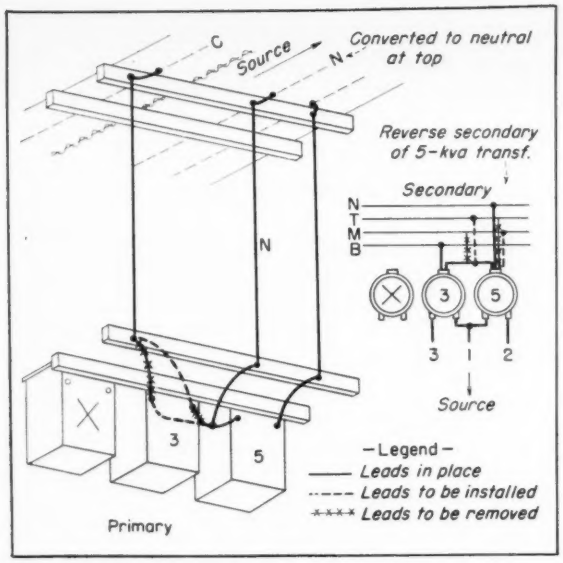
Placing Jumper . . . Assuming that the cutover is to be made on a weekend, the director moves into the town on Friday. The group leaders and crews attend a blackboard lecture on the details of the methods to be used. On large or complicated systems, the group leaders are also given a chance to look over their assigned areas.

On that Friday, a crew goes to the first pole from the substation to place a jumper between the middle phase, leaving the station and common neutral. This phase is usually designated "B" phase. It is used for identification because the middle phase does not always retain the middle position after leaving the station.

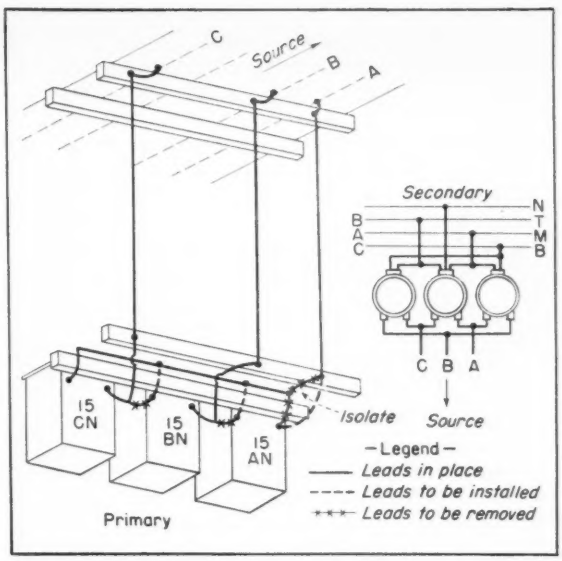
The jumper is first made through a fuse to check for bad arresters or other accidental ground. If the fuse does not blow, the jumper is made solid. Similar solid jumpers are placed between "B" phase and the common neutral at about three different locations out on the feeders. A high voltage neon test light is used to be sure that the jumper is at the same phase as the one at the station.

Director Takes Charge . . . On Saturday morning, the director takes over full responsibility and authority for all activities. No orders are issued except through him. His coordination of activities and elimination of conflicts is another key to success.

The group leaders and crews get another briefing and then are dispatched with their materials, trucks, and rubber protective equipment. As soon as each crew finishes an assign-



AT-THE-SCENE drawing of open delta transformer bank showing changes to be made on the lighting transformer, thus eliminating possibility of high voltage on lights. Field checks provide first hand knowledge of system and eliminate all possible physical conflicts



SKETCH is made of each three phase transformer bank showing physical layout of transformer risers and connections. "As found" connections are made in black pencil, and simplest changes possible to convert to wye are shown in red pencil

ment, it reports back to the director at some central location such as the company office or line headquarters. Recently two-way radio has eased our problem of contact.

Crew Removes Arrester . . . At each single-phase transformer, the crew removes one arrester and cutout, one transformer riser and the transformer end pins. The primary side of the transformer is permanently connected to the common neutral. On our system all grounding is common. A ground on the underside of the transformer hanger arm is usually tied into the common neutral; it is the most convenient place to connect the transformer primary neutral.

The other side of the transformer and riser remains connected permanently to "A" or "C" phase, as the diagram indicates. If the transformer is to be connected permanently to "B" phase and neutral, the arrester and riser are still stripped off and the other side is temporarily swapped over to "A" or "C" phase. After the conversion is completed, it can be put back on "B" phase. In this way, all removals are completed on the poles so that there is no chance of leaving a transformer across phases.

Grounding . . . The lineman checks the grounding system to see that it is bonded together and tied into the common neutral. After the transformer is reenergized, one of the crew checks the lights at the nearest house, thus eliminating callbacks later.

At each transformer beyond the point where one of the primary conductors is converted to a neutral, the riser, arrester, and other items, are stripped off and the permanent conductor is tied into the ground. This procedure eliminates going back to make temporary work permanent when the cutover is completed.

Indicate Changes . . . Sketches help to eliminate trouble. It is standard procedure to indicate changes on sketches of constant-current transformer installations and associated control switches.

On Sunday morning, crews armed with sketches are dispatched to any remaining unworked single phase installations or autotransformers on 2300-v service. Special clearance is necessary on waterworks or other service that must be maintained continuously.

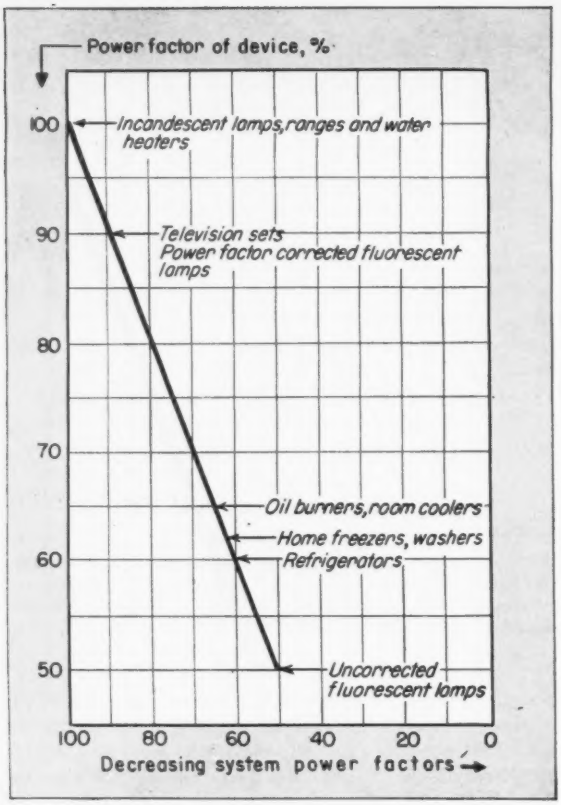
Usually, there are some three-phase banks that serve planing mills, spread houses, or other operations that have no need for service on Sunday morning. These customers are contacted in advance so that we can assign some crews to convert them during the Sunday morning hours.

Advance Arrangements . . . For Sunday afternoon, advance clearances are already made for whatever length of time is required for the substation crew to make the change. At the prescribed time, the substation is deenergized and the distribution lines are grounded out at as many locations as the foreman deems advisable.

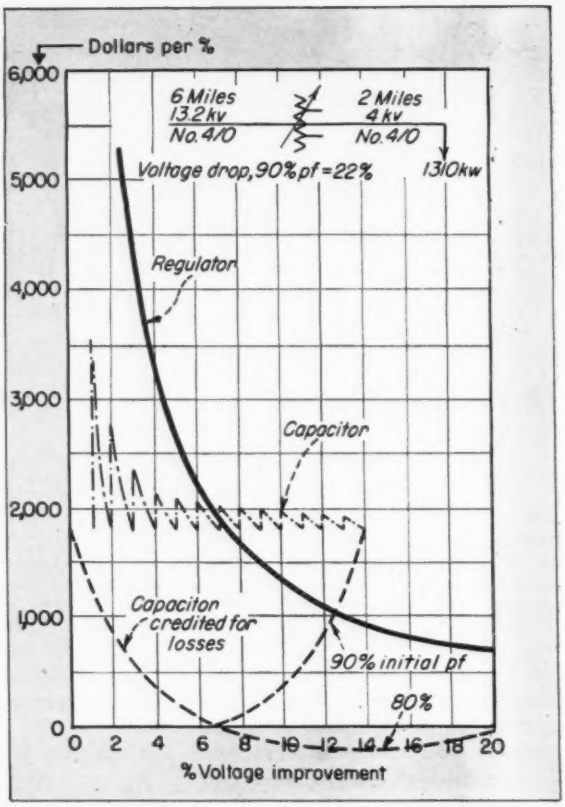
Each crew is given an equal number of three-phase banks to reconnect. If any crew has not completed all changes by the time limit set, they open cutouts on the remaining banks and then report off the line to the director. One crew removes all the temporary jumpers that were placed the day before between "B" phase and the neutral. As soon as all crews are cleared from the line, the clearance is given up, the ground removed, and the station is reenergized.

Immediately after the lines are reenergized, a man is dispatched to several three-phase loads, such as water pumping stations or gins, to check for correct rotation. At this point, the cutouts of banks changed during the morning may be closed and the rotation checked.

Total Interruption . . . The length of total interruption is always governed by the time required for the substation crew to make its change. We have made some conversions in as short a time as 50 minutes. However, the distribution crews can always get their banks pulled off the line if they are not changed fast enough.



DECLINING POWER FACTOR makes new residential devices troublesome. Peak pf may drop to 70% lag on many distribution systems



SWITCHED SHUNT CAPACITORS improve distribution voltage at less cost than regulators, particularly when credited for loss reduction

Capacitor Frontiers Still Expanding

V. A. RYDBECK, Apparatus Product Sales

P. E. HENDRICKSON, Capacitor Department, General Electric Co

Three times as many capacitors will be installed during the next 11 years as have been installed to date if utility loads meet the prediction of doubling during that period. The frontiers for capacitors are expanding rapidly.

Four factors are contributing to this expansion:

1. Increased loading on existing systems.

2. Increased use of appliances, fluorescent lights, and motorized devices with lagging power factors.

3. Increased distances and transformations between generation and load.

4. A changing ratio between capacitor and electrical equipment cost.

As loading on existing systems is increased, the kilovar requirements also increase. Thus high voltage lines, once a troublesome kilovar source even at peak load, now require several hundred kilovars per mile. Kilovar requirements of transformers increase approximately as the square of the loading; when load is doubled, kilovar requirements are increased four times.

Twenty-five years ago, the incandescent lamp with unity power factor represented a major part of the utility load. Today much of the new load such as refrigerators, room coolers, oil burners, etc. comes on at a lagging power factor. The peak power factor of new residential loads is no more than 70% on many systems.

For economic and geographic reasons there has been a trend toward large generating stations usually located some distance from the load. A higher voltage is now usually introduced between the generator and the distribution system. The effect is twofold from the capacitor point of the view. The additional reactance increases system kilovar requirements and increases the system investment. Both contribute to expanding the capacitor frontiers.

Changing Costs Require Restudy . . . Increasing usage and new developments have decreased the cost of capacitors in relation to that of other electrical equipment. A study of capacitor economics made a few years ago would probably not give a true picture today.

The switched capacitor for pole mounting has greatly increased the benefits obtainable by making it practical to install switched capacitors out on the distribution circuits. These equipments have been used to improve volt-

age regulation on many systems. The capacitor gives voltage improvement by drawing leading current through the reactance of the system. Thus voltage improvement is achieved even when power factor goes leading. As lagging power factor is improved to unity, the current flow in the circuit and losses are reduced. Thus switched capacitors give a double benefit by improving voltage and reducing losses.

When only the voltage improvement is evaluated, the regulator may be the more economical way of effecting this. But the reduction in losses alone may offset the cost of the capacitors. A few utilities have recently found it economical to operate some feeders at least temporarily in the leading range because of the necessity of obtaining immediate voltage relief.

Secondary Capacitors Improve Networks . . . In recent years power factors on the secondary network have decreased because of the increased use of air conditioning, circulating fans, fluorescent lighting, and small motors. Along with the decreasing power factor, the cost of capacitors in relation to the cost of other equipment in the network system has also decreased. The point of equality in improving power factor on most secondary networks would seem to occur at not less than 90% power factor. Because capacitors can be placed along the wall, over the transformer, or in a rack near the ceiling, the majority of the utilities have found it unnecessary to enlarge vaults.

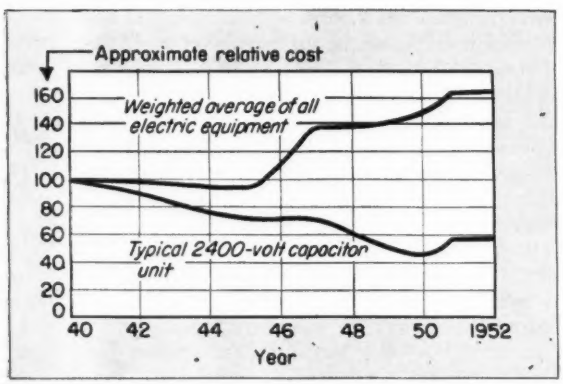
The low voltage capacitor in addition to releasing system kva improves both normal voltage and emergency voltage during a transformer outage. This ability to improve voltage can be a real economic benefit, particularly in fringe areas or where allowance is made for a second contingency.

Assume a two unit network. The addition of 90 kva of capacitors at each unit will give a 0.75% voltage rise in normal voltage. During the outage of one unit its capacitors give a 0.75% voltage rise in the remaining unit plus 2.6% voltage rise along the secondary. Thus the improvement in emergency voltage is 0.75 + 2.6 or 3.35%.

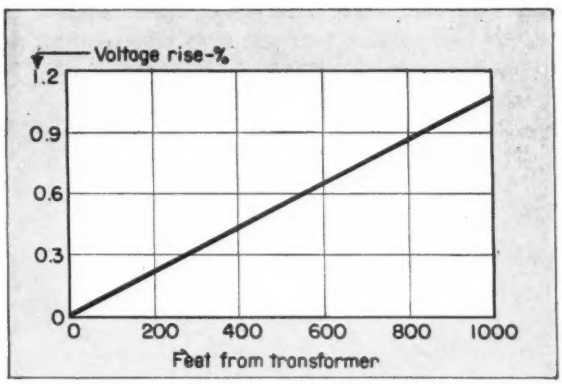
Secondary Capacitors Advantageous . . . Secondary capacitors go one step farther than primary capacitors and give in addition:

1. Reduced load on the distribution transformer.
2. Improved voltage in the secondary and in the primary beyond the point of primary capacitor application.
3. Reduced losses in the secondaries and in the primary beyond the point of primary capacitor application.

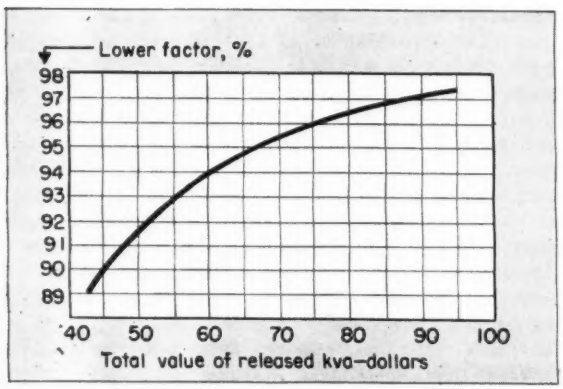
For maximum benefits secondary capacitors are ideal. But because they cost more than primary capacitors, additional costs must be compared with additional benefits.



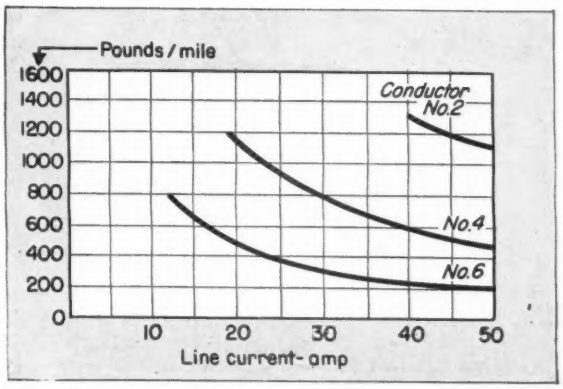
CAPACITOR PRICE DECLINES relative to electric equipment justifies correction of system pf to near unity to unload costly equipment



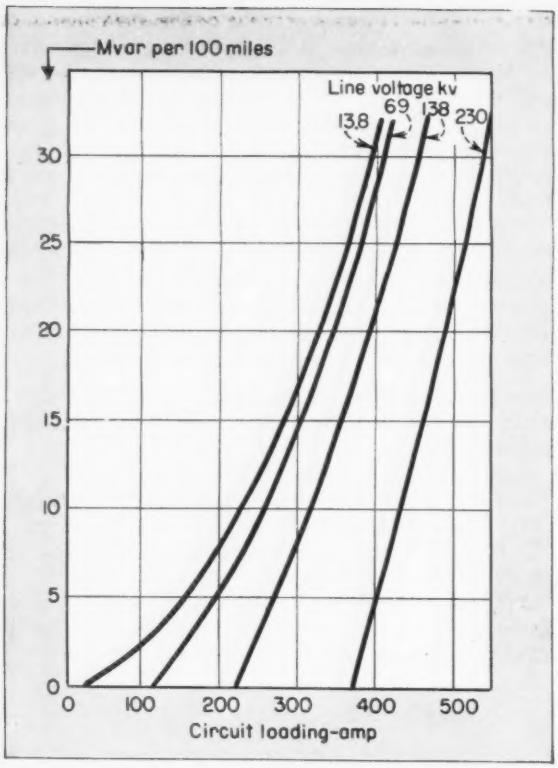
SECONDARY CAPACITORS RAISE SERVICE VOLTAGE. A single 3-kva unit on typical secondary main gives improvement shown above



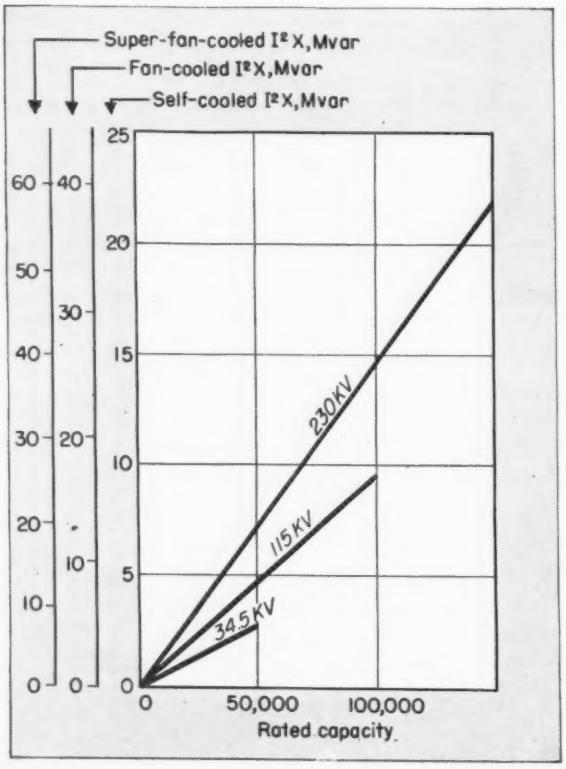
SECONDARY NETWORK POWER FACTOR CORRECTION to at least 90% may be justified by value of system capability released



CORRECTING 2.4-KV LATERAL VOLTAGE 1% requires up to 1,000 lb copper per mile. Only 17 3-kva capacitors give the equivalent



HEAVIER LINE LOADING INCREASES KVAR REQUIREMENTS. Increasing transmission voltage may not completely alleviate kvar need



SUPER-FAN-COOLED TRANSFORMERS INCREASE REQUIREMENTS, despite their contribution to economy for high-voltage systems

Primary capacitors release transformer capacity in the sub-stations. But secondary capacitors also release distribution transformer capacity, which has an investment per kva approximately three times greater than transformers in distribution substations.

The smallest economical installation of three-phase capacitors is 75 kva, with the installed costs usually decreasing relatively as the size increased to 300 kva. These capacitors are generally found on the 3-phase primary circuits rather than in smaller increments on single phase laterals. But the 3-kva capacitor for use on residential secondaries, which uses no arrester, cross-arm, cutout or hanger, has approximately a fixed cost per kva. When located on the last transformers of a primary circuit, it will give primary benefits beyond the point where it is considered uneconomical to further subdivide the size of primary capacitor installations. These benefits are in addition to the secondary voltage benefits.

Voltage difference between the first and the last customer can be improved by using secondary capacitors on the last distribution transformers. As practically all overhead circuits are voltage limited, this means that additional load can be taken on the circuit when secondary capacitors are used. With a large fixed investment in each primary circuit the ability to carry additional load can result in a substantial saving in system investment.

Conserve Critical Materials . . . If copper is difficult to obtain, another factor influences the use of secondary capacitors. There are more pounds of copper in single-phase primary laterals than in any other portion of the system. With growing loads, voltage drop in these laterals becomes an important consideration. Depending upon existing wire size, as much as 1,000 lb of additional copper per mile is required to effect a 1% improvement in 2.4-kv circuit voltage. This same improvement would be effected by 17 3-kva capacitors on distribution transformers one mile from the source, with less than 10 lbs of critical aluminum.

With growing loads, losses—amounting to 15-20% of all the kilowatt hours generated on some systems—become an even more important consideration. Studies of typical systems indicate that the secondary losses amount to more than the primary distribution and transmission losses combined. Primary capacitors can reduce the transmission losses and a portion of the primary distribution losses. But secondary capacitors can reduce transmission, primary distribution, and a major portion of the secondary losses.

Higher Voltage Applications Gain . . . Application of capacitors to circuits above 15 kv is a rapidly accelerating trend. Five years ago there were less than five capacitor banks installed in this country on high voltage circuits. Today there are more than 100 installed banks with a total capacity of over 800,000 kvar. These banks were installed primarily for voltage purposes. Unless a synchronous condenser is needed for stability reasons or for extremely fine kilovar control, the choice is between condensers and capacitors, largely influenced by the cost comparison between them. Factors which have influenced the use of more and more high voltage capacitor banks are their low initial cost, ability to be directly connected to the high voltage lines, lower losses, and relatively lower maintenance costs.

One of the factors to be studied carefully is the I^2X losses in the transmission system, both in the overhead circuits and in the associated power transformers. High voltage

lines which were previously lightly loaded are being required to transmit large blocks of power. This causes I^2X losses which are often greater than the kilovars which the line generates as a result of its distributed capacitance. For a 100-mile, 138-kv line carrying 400 amp, the net I^2X loss is approximately 22,000 kvar. A 100-mile, 230-kv line with the same current loading will produce a net I^2X loss of approximately 5,000 kvar. Even increasing the circuit voltage may not completely overcome the losses.

In many cases fan-cooled and super-fan cooled transformers add much toward system economy. However, the I^2X losses in such transformers will be greater than in self-cooled transformers and careful determination of how the losses will be supplied can result in further system economy. Also, as circuit voltages increase, the I^2X losses increase because of higher transformer leakage reactances. A 100,000-kva, 230-kv, super-fan-cooled transformer requires approximately 40,000 kvar for the I^2X losses. A self-cooled transformer of equal rating requires only approximately 14,500 kvar. But a 100,000-kva, 115-kv self-cooled transformer requires only approximately 9,000 kvar.

Capacitors Increase Transmission Capability . . . Not too many years ago high-voltage lines were not considered to be primarily voltage limited because of relatively light loadings even during peak loads. This was mainly because the conductor size was primarily determined by the mechanical and corona characteristics, and the amount of copper often exceeded that required from a voltage regulation standpoint. Over-voltage during light load periods was the primary concern. Therefore, a reactive load may have been needed to hold voltage down during light loads.

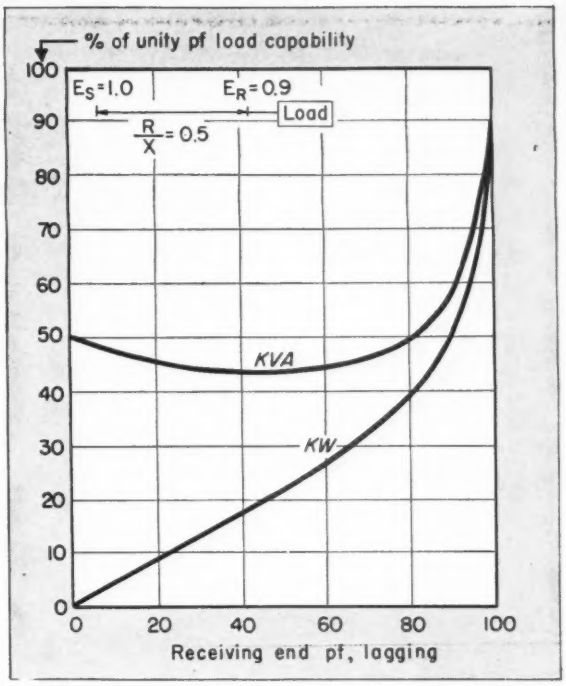
Today, with rapid load growth on transmission lines we find the picture reversed; low voltage at peak load periods often is the limiting factor, and high voltage during light load periods has become less critical. Capacitors are being used to reduce the kilovar load, and transmission systems are generally being operated at very high power factors to maintain the voltage during peak load periods.

For an example of what high power factor means in the amount of power that may be carried over a given line even with an R to X ratio of 0.5, when the voltage drop is limited to 10%, refer to curves above. From these curves we see that 56% of the kva load and 50% of the kw load may be carried at 90% power factor as compared to unity power factor. Many transmission lines have an R to X ratio as low as 0.2 which makes operation at high power factors even more important.

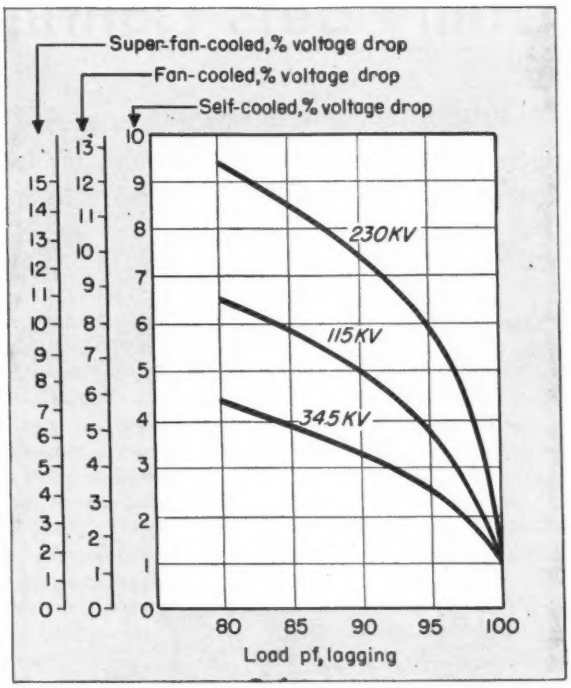
Voltage drop through higher voltage transformers makes it almost imperative to operate them at power factors higher than 90-95%. If the power factor were 95% at full load, the voltage drop would be 5.75% for a 230-kv self-cooled transformer. For a super-fan-cooled transformer, the voltage drop would be 9.6%.

If it is desired to operate a transmission line at or near flat voltage, we may find that kilovars in excess of those required to maintain the load at unity power factor are needed. When the power received is 100,000 kva, it will take 53,800 kvar or 42,000 kvar of leading kilovars to hold the receiving end voltage at 100% or 95% respectively. Hence we find the receiving end power factor 87% leading when 100% voltage is maintained and 92% leading when 95% voltage is maintained.

Capacitors have often been used as the necessary source of kilovars to maintain voltage in this manner. They can be directly connected to the line just ahead of the transformer; hence, the desired voltage rise may be obtained over the transmission line and yet the transformer kva requirements be kept near unity power factor.



IMPROVING RECEIVING END POWER FACTOR increases load capability of short transmission line limited to 10% drop in voltage



SUPER-FAN-COOLED TRANSFORMERS DROP VOLTAGE because of regulation, require load power factor improvement to compensate

OFFICE SPACES have fixtures placed to give light same directional quality as natural daylight. Light intensity on desks is 100 ft-c

Utility Sets Lighting Example

Offices located temporarily in warehouse are lighted inexpensively but are first-class examples for local industry and business to follow

J. FRANCIS WHITNEY, Engineer, Eugene Water & Electric Board, Eugene, Ore.

The new warehouse building and vehicle maintenance shop of Eugene Water & Electric Board have been lighted to gain these objectives:

1. An adequate wiring and lighting system as an example for local industry and commercial business.

2. A relatively inexpensive lighting system because engineering and business offices are located in warehouse only temporarily.

Warehouse and shop are first of a group of buildings the Board plans to locate on the site. Ultimately an office building including a drive-in pay station will be built. Until then the warehouse is housing engineering and business offices, which then will be moved to make room for more warehouse space and the meter department. The cafeteria located in the basement at one end of warehouse building will not be moved.

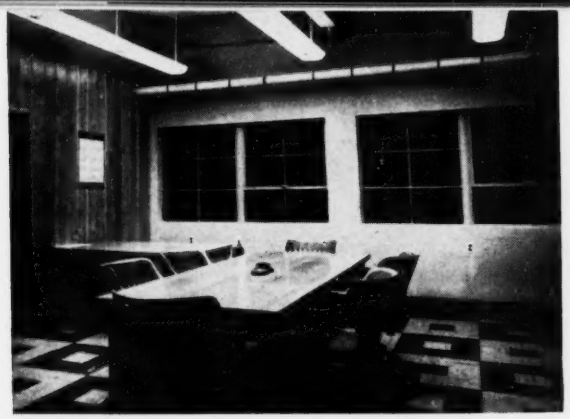
Expensive innovations such as luminous ceilings or indirect lighting were immediately ruled out. Matching two-tube and four-tube luminaries were selected. They have 45-deg shielding lengthwise and 35-deg shielding crosswise. Light distribution is 60% upwards and 40% downwards. Total cost of the installation, including wiring, was $28,000.

Fixtures are staggered across the three phases of the 120/208-v wye system to minimize stroboscopic effect. In the drafting room, continuous rows of two-tube, 40-w fluorescent fixtures are installed at 45-deg angle to length of room. Fixtures may be switched on in three groups each providing 35 ft-c to compensate for decreasing daylight. Location of fixtures on each phase is shown in the accompanying diagram.

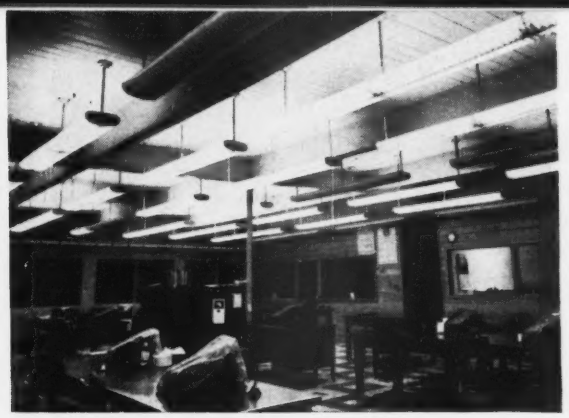
In the engineering offices one four-tube fixture is located near and parallel to the windows to give artificial light the same directional quality as natural light. An unusual feature is the relatively high intensity of hall lighting along the glass-partitioned offices. Because minimum recommended value of 5-ft-c for hall lighting would have provided too great a contrast for comfort in the offices, light intensity of 35 ft-c is provided by individual two-tube fixtures. Light intensities given in the accompanying picture captions are foot-candle readings taken after one year's operation of the system.

Certain key fixtures in the office spaces are located so that critical office areas may be observed readily by a watchman from outside the building.

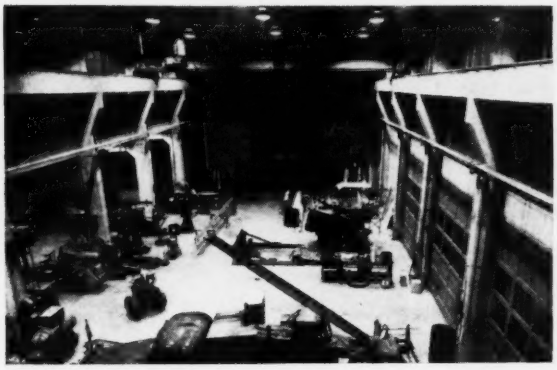
Although fixtures in the warehouse area can accommodate either 300 or 500-w lamps, the initial installation was with 500-w lamps. The machine shop in the vehicle maintenance building is lighted by RLM type silver bowl diffusers with Alzak aluminum inner reflectors and 500-w silver bowl lamps.



CONFERENCE ROOM is wired so that center row of fixtures may be switched separately to cut glare on table. Intensity is 50 ft-c



ACCOUNTING ROOM is lighted to 60 ft-c by broken rows of two-tube fixtures, some of which are off to eliminate glare on machine keys

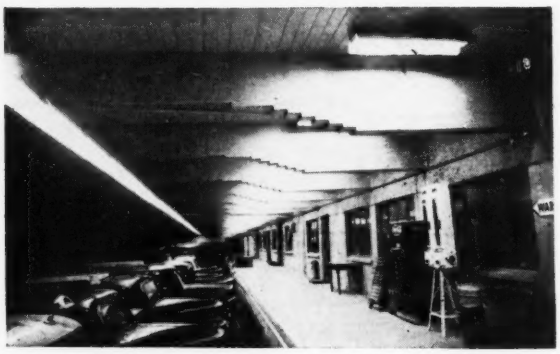


VEHICLE SHOP has 46 ft-c on floor from 1,000-w incandescent, high-bay units. The machine shop at upper left has 500-w silver bowl lamps

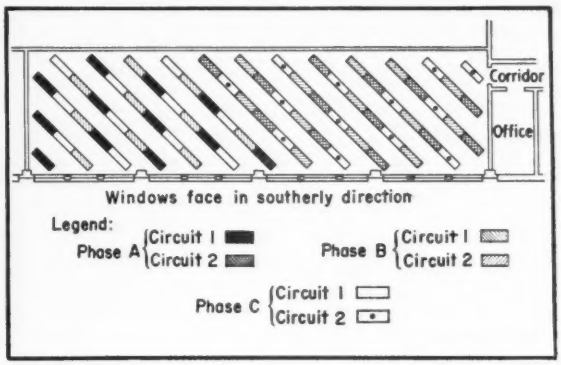
NIGHT LIGHTS consist of certain key fixtures which illuminate the critical office areas visible to the watchman from outside building

CAFETERIA has effect of indirect lighting provided by deep beams with good reflectance. The four-tube fixtures provide 35 ft-c

WAREHOUSE has 45 ft-c on floor from 72 RLM dome reflectors and 500-w lamps spaced 12 ft apart with 14 ft between the rows

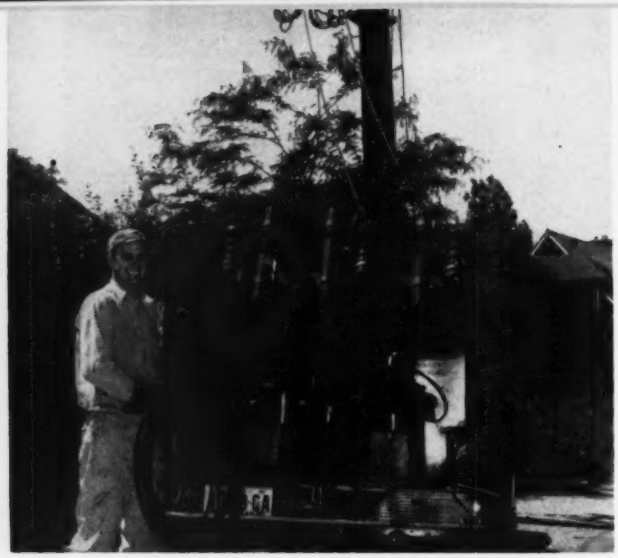


LOADING DOCK is lighted to 30 ft-c by individual and a continuous row of industrial luminaires. Row over trucks provides night light



FIXTURES STAGGERED across phases lessen stroboscopic effect in drafting room. Each phase group switches separately to give 35 ft-c

PORTABLE DETECTOR guides lineman to fault.



SIGNAL GENERATOR puts identifying buzz on grounded circuit.

Thyratron Tube Locator Spots Overhead Grounds

FRANK M. HARTZ, Assistant Supervisor, Radio Section, Detroit Overhead Lines, Detroit Edison Co, Detroit, Mich.

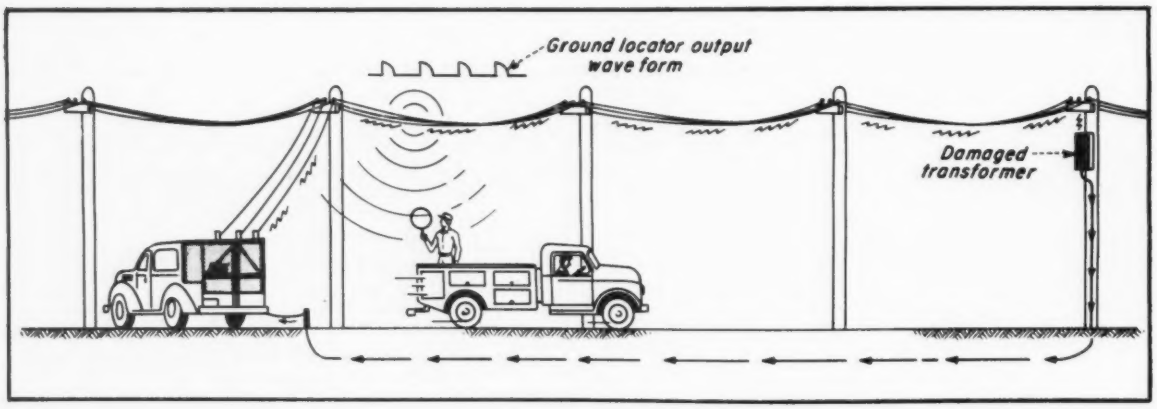
Spotting grounds on Detroit Edison's overhead system has been made easier by a new thyratron-tube ground locator. This equipment has been successful in finding about 90% of the ground faults. It is easily adaptable to underground systems.

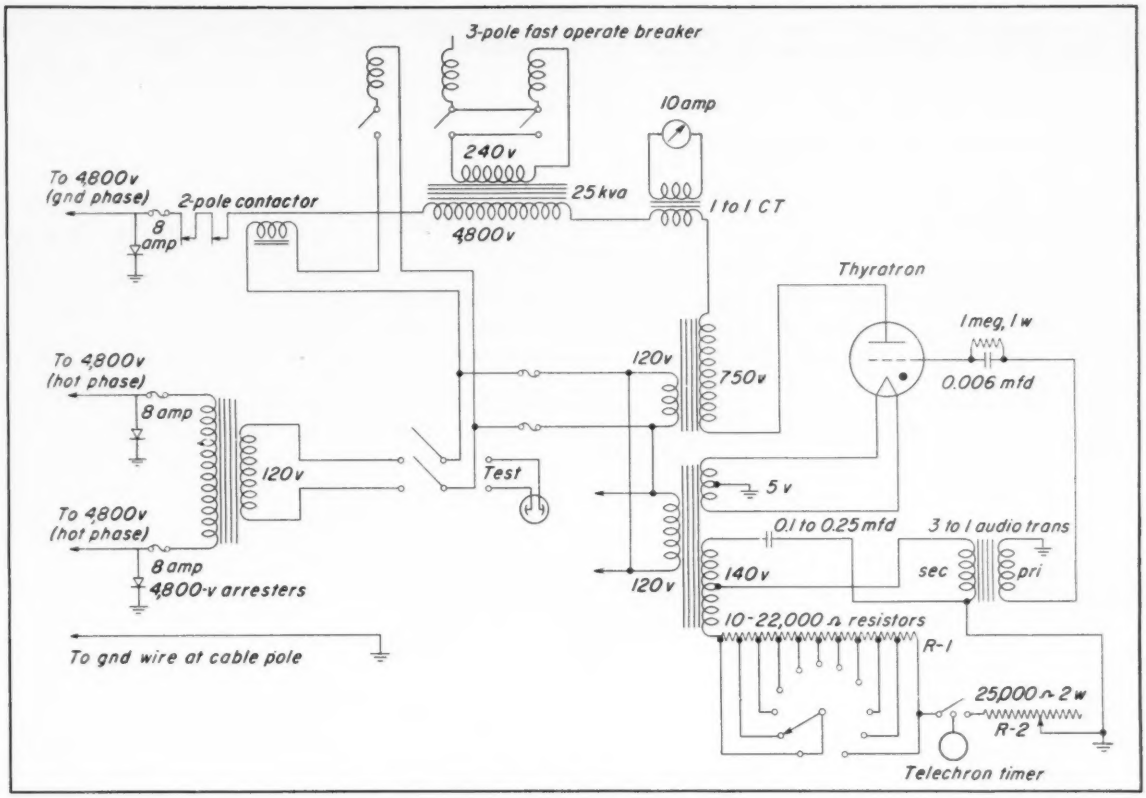
What It Is . . . Essentially, the locator consists of a signal generator and a detector. The signal generating equipment is carried in a panel truck modified to handle the size and weight of the associated power supply and protective equipment. The detection equipment is light enough to be carried by a lineman as he rides or walks along the faulted circuit.

How It Works . . . Normally, Detroit's primary distribution system operates at 4,800 v between phases. It is connected 3-phase ungrounded delta. When a ground appears on a substation bus, equipment at the substation determines which circuit is grounded. Then the ground locator truck is driven close to the feeding point of the grounded circuit.

On the trouble site, the locator's 5-kva power supply is connected to the two ungrounded phases of the circuit, actuating the thyratron tube in the signal generator. One lead from the generator is hooked up to the grounded phase while the other lead is connected to a good ground, thus putting a signal on the line.

Meanwhile, a lineman travels along the circuit carrying loop-type detection equipment and listening for the ground locator signal in an earphone. When he reaches the ground fault, the coupling between the loop and the ground wire on the pole is highest, making the received signal very strong. Beyond this location, the





WIRING DIAGRAM of signal generator shows timer-controlled Thyratron powered by "hot" phases to put buzz on faulted phase to ground

signal drops off rapidly to zero in the case of a radial or lateral circuit. With a ring main, however, the signal does not decrease to zero.

Signal Self-identifying . . . What the lineman actually hears is a rough 60-cycle buzz. It contains a spectrum of audio frequencies, making it the best bet for locator work. If standing waves or reflections cancel any specific frequency, most of the signal still is left for locating the fault.

Even an inexperienced lineman operator has little difficulty in distinguishing the signal. It is made easy to identify by a synchronous timer which interrupts it at regular intervals. Such interruption also reduces heating of the power transformers.

Detection equipment is readily transportable, weighs only 5 lbs. It consists of a loop, a three-stage audio amplifier, and an earphone.

Most of the weight is in the 4-lb loop. The loop is a 1-ft diameter turn of ½-in. thin wall conduit containing No. 28 enamel wire. An air gap at the handle is covered with an insulated weatherproof brass section.

Amplifier weight is held down by the use of printed circuitry. Both the amplifier and its batteries are mounted in a small shield can which fits a man's pocket. The amplifier draws so little that the life of batteries is almost equal to their shelf life.

Locator Hookups Simple . . . The ground locator is powered from the two ungrounded 4,800-v primaries, making it possible to maintain control of the thyraton at all times.

If there is only a partial ground, the phase of this power supply voltage becomes important. In such a case, voltage from the faulted phase to ground adds vectorially to the 750 v of the power transformer.

When ground fault is cleared, protective devices take over to prevent damage to the locator equipment. Normally the voltage from the grounded phase to ground rises to 2,700 v. Resulting current could damage the low impedance locator.

At this point, a fast acting circuit breaker inserts a reactance in less than five cycles after the ground fault has cleared. The current is limited to 50 milliamperes by the 25-kva, 4,800-240 v transformer, which functions as a variable reactor. As soon as the current is reduced, a slow-operating, two-pole contactor drops out, clearing the locator from the line.

Equipment is Flexible . . . Although this locator was designed specifically for use on 3-phase, delta-connected, ungrounded distribution circuits, it can be used on other types of circuits if the equipment is powered from the primaries. Its signal will travel on overhead lines or underground cable.

About 10% of the grounds encountered by Detroit Edison crews are partial ground faults. In these cases, if the impedance of a customer's load near the fault is lower than the impedance of the ground fault, the locator signal will travel out along the faulted phase and return via the two hot phases.

When the signal takes this path, the man with the detector will hear no signal because the magnetic fields will cancel. A listening coil coupled to each primary wire can identify such a condition.

Budget Bureau Calls for Cuts

Directive to all federal agencies to affect power program in several ways, if rigidly applied

Federal power development and marketing programs are in for sharper cutbacks.

A toughly worded directive from the Budget Bureau to all federal agencies call for the drastic reduction of federal expenditures at every point possible.

While the budget memorandum is aimed primarily at the fiscal 1955 budget it also applies to spending during the present fiscal year.

Effects Listed . . . If rigidly applied, the directive could have these effects on the federal power program:

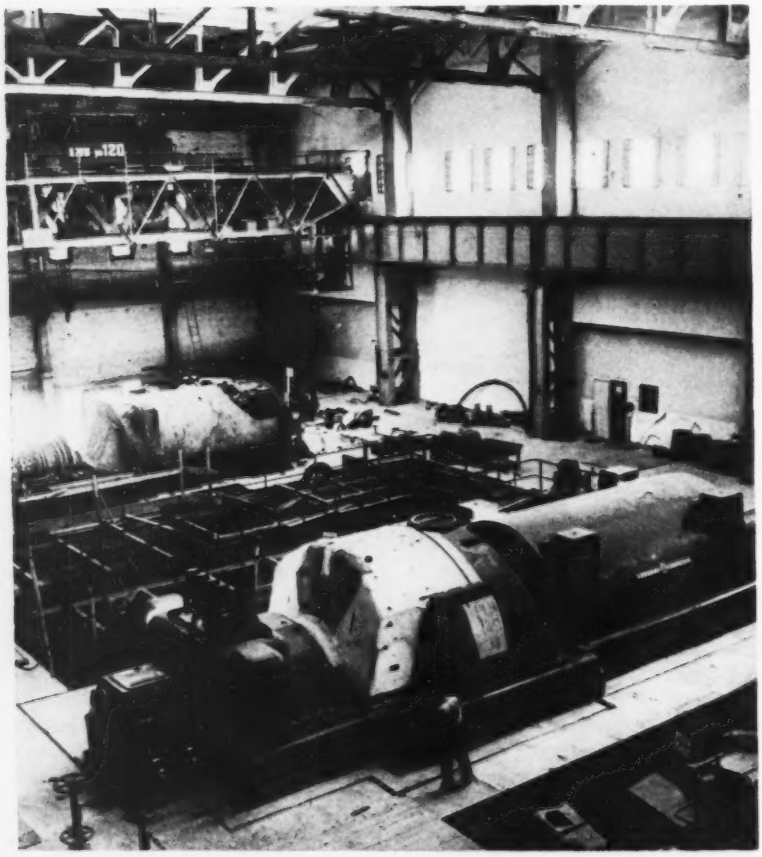
- Prohibit all new starts on hydroelectric projects, hold building of transmission lines to a minimum, and stretch out schedules of projects already under way.
- Reduce personnel in all agencies connected with federal power development or federal regulation over nonfederal utilities. (See page 73).
- Encourage disposal of federally owned electrical facilities.
- Encourage agencies to drop activities that are not amply authorized under existing law.

And Beyond That . . . The directive, signed by Budget Director Joseph M. Dodge, goes even further. It urges federal officials to suggest new laws for relieving the government of unnecessary functions.

Dodge's policy letter does not forecast federal withdrawal from public works construction. On the contrary, he asks construction agencies to put increased emphasis on planning. Object: To have a backlog of high-priority projects ready to go when the government can afford them—or when a construction slump calls for some federal help.

Congress and the Budget Bureau have already stretched out one or two big federal hydroelectric projects. At The Dalles on the Columbia River, for example, they figured that power generation could be delayed a year without extra cost to the government.

But officials believe there are few, if any, other going jobs that can be similarly delayed without loss.



Israel Increases Power Supply

Completion of a 50,000-kw power unit (shown above) in the Reading Power Station at Tel Aviv boosts Israel's electric supply by 40%. Palestine Electric Corp, which supplies power throughout Israel, is rushing completion of a second 50,000-kw unit to meet the increasing demand for power. The unit (pictured in background) is expected to be placed in operation in early 1954. The nation's supply also consists of a 90,000-kw plant at Haifa, a 36,000-kw plant, and a 4,000-kw diesel station in Tel Aviv.

POWER BRIEFS

- Plans to build a new $20 million power plant on a site across the Houston ship channel have been announced by Houston Lighting & Power Co. The plant, which will house a 165,000-kw generating unit, is scheduled to go on the line early in 1956. The new unit, together with three others now under construction, will boost the utility's net capability from 840,000 kw to almost 1.4 million kw.

- The National Safety Council has presented to Mississippi Power Co the Award of Honor, the council's highest award for accident prevention. It was given for "an outstanding safety performance in 1952." The council also gave an Award of Merit to Ohio Power Co in recognition of the company's safety record.

Other items in the week's news will be found starting on page 164.

WASHINGTON COMMENT

JESSE MOCK

A glimpse behind the scenes adds depth to the Republican power policy announced last month. (EW, Aug. 31, p 7). It throws some light on the reasons for the comprehensive policy statement and the men who put it together.

Why the GOP Quickly Revealed Its Power Policy

The Democrats were in office for nearly 13 years before the late Interior Secretary Harold Ickes got around to setting down a power policy. (EW, Aug. 31, p 7). The Ickes memorandum, which directed a dominant federal role in power development and marketing, was signed Jan. 3, 1946—shortly before Ickes returned to private life.

GOP Set Policy in Just Seven Months . . . Now the Republicans have come along in just seven months and put together a guiding statement for Interior Department covering virtually the same points as the Democratic statement.

Reasons for the comparative rush seem to boil down to these:

- The Ickes memorandum on power was still nominally in force and an overriding GOP statement was needed for guidance of Interior's far-flung organization dealing with power matters.
- Administration leaders, particularly Interior Secretary Douglas McKay, wanted a positive, constructive approach to the policy problem rather than a negative one. It could have adopted the negative course merely by cancelling the Ickes memorandum.
- Some long-range policy statement was needed to answer numerous pressing questions put to Interior by both public and private power groups.

A corollary to these was the need for a carefully written and well-documented statement on this controversial subject for use in the many coming political campaigns.

McKay Saw Need For Policy . . . It is safe to say that Secretary McKay felt the need for such a guiding statement well before he actually took over the reins at Interior. His testimony preceding confirmation by the Senate contains some suggestions that were later incorporated in the general statement.

But it was Undersecretary Ralph Tudor, a career engineer, who pushed for the kind of brief, clear-cut statement that finally came out. Probably his immediate impetus came from the barrage of power policy questions that came to him during his first weeks at Interior.

He had one Interior lawyer assigned the task of going over the laws pertaining to federal power development and marketing. This lawyer also took into consideration the views expressed in public speeches by President Eisenhower, McKay, and probably Assistant Secretary Fred G. Aandahl.

Ickes Memorandum Could Not Be Ignored . . . It is a fairly safe assumption that the old Ickes memorandum was always in sight during these studies, and the result was mainly a counter statement to the one written by the former Democratic Administration.

Once the rough draft of the basic policy statement was finished, Tudor and McKay took over. By late July the statement was in near final form and had the tentative approval of the White House staff and President Eisenhower. At this point it was decided that some sort of preamble or introduction was needed.

This was a product of the Interior and White House staffs with Presidential Administrative Assistant Gabriel Hauge acting as a coordinator. Some of the language of the preamble was probably written by Hauge, a former Business Week magazine editor.

McKay and the Interior staff had set a tentative Aug. 1 deadline for the statement in hopes that it could be presented at the governors' conference in Seattle by either McKay or possibly by the President. However, it was decided that clearance and advice was needed from other government agencies and Republican Congressional leaders. This procedure required several weeks. The policy statement was not released to the public until Aug. 18.

Larry G. Smith, Interior's director of information, handled release on the statement timing it to precede an endorsement from President Eisenhower.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Southern pine constituted 75% of the poles preservatively treated in 1951, western red cedar 7.3%, lodge pole pine 5% and Douglas fir 6.7%.

Excessive voltage drops are a usual consequence of large kilovar flows. Kilovar generation and kilovar consumption should not be far apart, quantitatively or geographically.

Flyash has very little effect on the shrinkage of concrete.

Congo River power in Africa may be transmitted to Europe at high voltage direct current if investigating European engineers can persuade others that the 3,000 miles is not economically unfeasible.

Carrier current may not pass into the coupling capacitor and the receiver if the contact is poor at the point where the coupler is tapped to the line.

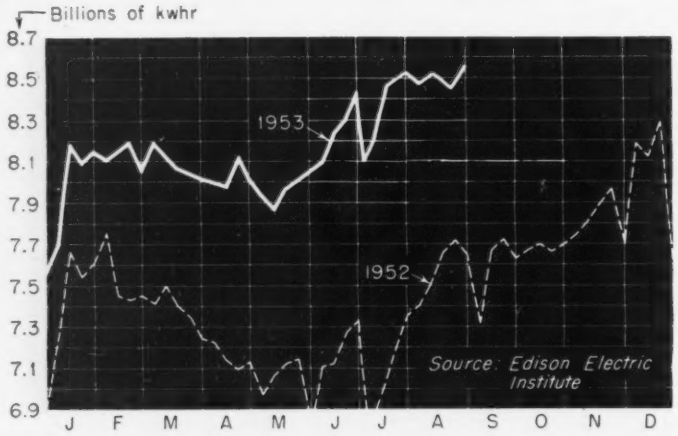
Grouting repair of dams exposed to ice should be done (preferably in Spring) when the concrete is at a temperature just above freezing because cracks and voids are then largest due to contractions.

Coating resistance of 10,000,000 ohms per square foot was specified and achieved on a particular high voltage pipe-line job.

Resilient mounting of transformers may fail to minimize noise if it sacrifices any appreciable part of the mechanical solidity of the whole assembly.

Drip-proof motors are protected from water dripping or falling on them at any angle within 15 degrees of the vertical—splashproof within 105 degrees of the vertical.

STATISTICS



Output Week Ended Aug. 29—8,539,557,000 Kwhr

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Aug. 29	+11.7	+10.8	+10.1	+11.8	+10.4	+25.4	−1.6	+8.6	+5.7	+7.1
Aug. 22	+9.2	+9.4	+5.8	+8.6	+5.4	+20.2	−0.8	+9.5	+5.1	+8.2
Aug. 15	+11.6	+8.4	+6.2	+12.3	+7.9	+21.3	+7.5	+8.8	+7.5	+10.2

Electric Power Statistics

		Latest Month	Preceding Month	Year Ago
Peak Load (Million Kw)	May	73.5	72.9	65.9
Capacity (Million Kw)	June	85.06	84.34	77.46
Production (Billion Kwhr)	June	36.83	35.98	31.53
Hydro	June	9.10	10.29	9.16
Fuel	June	27.73	25.69	22.37
Fuel Consumption				
Coal (Million Tons)	June	9.06	8.59	7.66
Oil (Million Barrels)	June	6.12	6.09	3.91
Gas (Billion Cu Ft)	June	103.73	87.85	89.29
Sales (Billion Kwhr)	June	31.77	31.32	27.67
Residential	June	8.37	8.50	7.44
Commercial	June	5.46	5.18	5.00
Industrial	June	15.80	15.49	13.20
Other	June	2.14	2.16	2.03
Net Income Class A & B Companies ($ Million)	June	77.81**	82.13	71.03
Estimated Dec. '53 Peak (Million Kw)	June	86.2	86.1	88.3
Kwhr per Residential Customer (12 Month Average)	May	2,241	2,224	2,079
Revenue per Kwhr Residential Service (12 Month Average)	May	2.76¢	2.76¢	2.78¢
Canadian Production (Billion Kwhr)	June	5.26	5.76	4.99

Business Statistics

FRB Industrial Production Index†††	June	242*	240	205
Gross National Product Annual Rate ($ Billion)	2nd Qtr.	372.4	362.0	345.1
EW 5 Industry Production Index	July	130.6	130.9	95.6
ENR Construction Cost Index††	July	126.6	124.4	119.6
BLS Consumer's Price Index	July	114.7	114.5	114.1
NEMA Insulation Materials Sales Index†	June	174.4	173.9	137.7
NEMA Electric Appliance Sales Index†	June	105.2	107.9	113.6
NEMA Household Refrig. Sales Index†	June	88.3	80.5	97.5
Metal Prices (Sept. 1)				
Copper, Conn. V., lb		$ .29-.30	$ .29½	$ .24¼
Lead, N. Y., lb		.14	.14	.16
Zinc, prime Western E. St. Louis, lb		.11	.11	.14
Tin, Straits, qual. N. Y., lb		.83¼	.78¼	1.21½
Aluminum, ingot, base price		.21	.21½	.20
Nickel, base price		.60	.60	.56½
Steel, billets, Pitts., ton		62.00	62.00	56.00
Steel, scrap, No. 1 heavy, Pitts., ton		42.00-43.00	44.00	46.00

*Preliminary **Revised †1947-49=100 ††1949=100 †††Unadjusted

Inventories & Sales Show Substantial Gains

The record volume of manufacturers' sales in the second quarter was accompanied by a $1.4 billion rise in inventories. June shipments were virtually unchanged over May but were

June Manufacturers' Sales

Seasonally Adjusted

	Millions of Dollars 1952	1953
Primary Metals	991	2,191
Iron and steel	218	1,161
Other	772	1,030
Electrical machinery	1,154	1,376
Machinery (excl electrical)	1,964	2,044
Industrial machinery	806	788
Other	1,158	1,256
Motor vehicles and equipment	1,815	2,263
Motor vehicles	1,527	1,946
Parts and accessories	288	318
Instruments	265	362
Paper and allied products	625	741
Chemicals and allied products	1,495	1,773
Industrial chemicals	602	727
Drugs & medicines, soaps	359	406
Other	534	640
Petroleum and coal products	1,945	2,188

29% over last year's. Sales of electrical machinery reached new highs during the month while motor vehicles and primary metals were off 2 and 7% respectively.

Inventories held by nondurable-goods producers totaled $19.7 billion

June Manufacturers Inventories

Seasonally Adjusted

	Millions of Dollars 1952	1953
Primary metals	2,945	3,200
Iron and steel	1,636	1,802
Other	1,310	1,398
Electrical machinery	3,107	3,423
Machinery (excl electrical)	5,461	5,544
Industrial machinery	2,011	1,926
Other	3,451	3,618
Motor vehicles and equipment	2,562	3,300
Motor vehicles	2,030	2,720
Parts and accessories	532	580
Instruments	762	818
Paper and allied products	1,028	966
Chemicals and allied products	3,011	3,086
Industrial chemicals	1,246	1,205
Drugs & medicines, soaps	760	733
Other	1,006	1,148
Petroleum and coal products	2,607	2,814

Source: Dept. of Commerce

in June, or about $150 million above May. Durable-goods stocks rose to $25.7 billion with the largest advances occurring in primary and fabricated metals.

FPC's Rate of Return Policy Reversed

C. P. GUERCKEN, Assistant to Vice President, Ebasco Services, Inc.

A decision has recently been handed down by the United States Court of Appeals for the Eighth Circuit Court in the case of Northern Natural Gas Co vs the Federal Power Commission which may have a material bearing on the regulation of electric utilities.

While the petition for review covered ten points of contentions by Northern Natural, the following three are of major interest to the electric industry:

1. The amount allowed as interest during construction.

2. The amount allowed as working capital.

3. The question of the adequacy of the 5½% rate of return.

Interest During Construction . . . On this point the court upheld the FPC in its contentions that, "We have generally allowed the actual cost of borrowed funds and a 6% rate of interest on corporate funds used for construction purposes. It has been our practice to refuse to allow the capitalization of interest during construction at rates which would **result in a high profit during construction for the allowance is not for the purpose of providing the company with a fair rate of return before operations begin.** It should be noted that the bold-faced instruction relates to 'interest'. We believe that 6% is the maximum rate that can be claimed in these times."

It is difficult to understand why there should be a differentiation in the rate of return on construction work in progress as compared to the return on utility plant.

What difference, if any, is there between an insulator installed on a line in service and the same insulator affixed to a transmission tower under construction and charged to construction work in progress? Why should the investor in one insulator be favored over another investor who has put up his money for a similar insulator?

Risks Greater . . . On the contrary the risks of the enterprise are probably greater during construction than when the plant is put into commercial operation and producing revenue. If anything, instead of reducing the rate of return to a maximum of 6% on the invested funds, the FPC should permit a return higher than the allowable return on the "used and useful rate base." This will compensate the new and prospective investors during the time that their capital is brought to full fruition as well as safeguarding existing investors from a dilution of their equity.

Investor Is Discriminated Against . . . The FPC practices rank discrimination in preferring one investor to another (to the general detriment of all investors) when it claims that the construction period is separate and apart from all other times in the life of the utility. It would seem then that unless other and more cogent argument can be produced by the FPC such a theory can only be based on the more practical aspects of reducing the allowable earnings by one means or another whether such reasons are equitable or not.

In this connection, the Illinois Commerce Commission, in its recent decision on Peoples Gas Light & Coke Co. led the way to a fair and equitable treatment of interest during construction. The ICC allowed the full rate of return on a rate base which included construction work in progress on which no interest during construction had been capitalized. It is of interest to note that the Circuit Court said:

"Northern refers to no court decisions in support of its complaint against the action of the commission, and manifestly the commission's determination of the amount allowable for the purpose in question was within its especial province and jurisdiction."

From the foregoing it would appear that unless some prior court decision, in support of its claim, could be quoted, economic equity gets little, if any, standing in this court.

Working Capital . . . On the FPC's allowance for working capital, the court merely sustains a fundamentally erroneous theory of allowing the commission to further reduce a utility's rate base under that specious guise of "customer contribution in advance of needs." Even under a fair rate of return theory (which the Northern case does not happen to be in view of the commission's allowance of the 5½% rate of return) all of the net capital funds are provided by the security holders plus plowed-back earnings represented by the surplus account.

This formula eliminates accrued federal income taxes 100% as well as all other liabilities of the company. This is known as the net investment theory without any differentiation between fixed assets and working capital.

The working capital is represented by the difference between net investment in plant and the total funds supplied by the investors. The commission's theory is to take 45 days of adjusted operating expenses (which excludes taxes) plus materials and supplies from which is deducted 75% of the accrued federal income taxes.

Says Commission Staff Errs . . . FPC staff has erred in deducting the above taxes from operating expenses which do not include federal income taxes. This can result in negative working capital allowances which, of course, is ridiculous. The next logical step would be to deduct state and local taxes as well as all other liabilities. In the final analysis, such a procedure is tantamount to confiscation of the investors' moneys and is merely another phase of regulatory attrition.

It is also questionable whether regulatory bodies ought to compel public utilities to depend on their income tax accruals for the cash they require for general corporate purposes.

Adequacy of 5½% Rate of Return . . . On the question of the adequacy of the 5½% rate of return, it would appear that a serious set-back has been given to the cost of money theory under which the FPC and other original cost jurisdictions have operated for so long.

The court, in remanding this case to the commission, ordered it to set out more fully the facts and the rea-

Today in Utility Finance

YIELDS (%)

Quality	Bonds 1st	Bonds 2nd	Bonds 3rd	Preferred Stocks 1st	Preferred Stocks 2nd	Preferred Stocks 3rd	Common Stocks 1st	Common Stocks 2nd	Common Stocks 3rd
DATE									
1953									
Aug. 27	**3.28**	**3.32**	**3.52**	**4.31**	**4.50**	**4.78**	**5.31**	**5.81**	**5.86**
Aug. 20	3.28	3.32	3.51	4.31	4.51	4.77	5.27	5.80	5.83
END OF QTR									
2nd 1953	3.34	3.46	3.64	4.47	4.70	4.88	5.52	5.93	6.10
1st 1953	3.15	3.23	3.39	4.16	4.41	4.66	4.95	5.24	5.50
4th 1952	2.99	3.03	3.14	4.06	4.22	4.59	4.98	5.33	5.62
3rd 1952	2.99	3.03	3.16	4.10	4.26	4.61	5.18	5.59	5.96

Data: Reis & Chandler, Inc.

EARNINGS

Company	Period Months Ended		Net Income 1953	Net Income 1952	Earnings Per Common Share 1953	Earnings Per Common Share 1952
Alabama Power	12	July	$12,432,102	$11,530,930	$....	$....
Delaware Power & Light	12	July	3,994,696	3,325,810	1.97	1.64
Detroit Edison	12	July	20,278,525	15,628,603	1.92(a)	1.60(a)
Georgia Power	12	July	12,189,081	11,257,254	....	....
Iowa Southern Utilities	12	July	1,350,892	872,525	1.93(b)	1.26(b)
Louisiana Power & Light	12	July	3,463,636	2,818,737	....	....
Middle South Utilities, consolidated	12	July	14,596,996	12,459,076	1.96(c)	1.90(c)
Minnesota Power & Light	12	July	3,951,534	3,139,397	3.93	2.98
Portland General Electric	12	July	3,651,652	3,604,061	2.43(e)	2.70(e)
Shawinigan Water & Power	6	June	2,967,546	2,743,053	....	....
Southern Co, consolidated	12	July	21,369,550	19,406,600	1.18(f)	1.13(f)
Southwestern Power Administration	12	June	2,829,553(g)	2,635,193(g)	....	....
Tampa Electric	12	July	2,577,129	1,950,834	3.59	2.92
Virginia Electric & Power	12	July	12,367,403	11,317,447	1.86	1.66

Notes—(a) Based on 10,584,888 shares in 1953 and 9,772,628 shares in 1952; (b) Based on 623,205 shares in 1953 and 566,161 shares in 1952; (c) Excluding tax reduction due to Amortization of Emergency Facilities and based on 6,768,750 shares in 1953 and 6,250,000 shares in 1952; (e) Based on 1,500,000 shares in 1953 and 1,333,333 shares in 1952; (f) Based on 18,087,643 shares in 1953 and 17,076,669 shares in 1952; and (g) Gross Income.

FINANCING

Company and Description	Amount of Offering (000)	Offering Price	Yield to Public / Bid Date
WEEK OF AUGUST 27—SEPTEMBER 2			
Bonds			
Wisconsin Power & Light—1st mtg 4% due 1983	$8,000	102.655%	3.85%
Duke Power—1st and refunding mtg 3¾% due 1983	35,000	102.55	3.61
Common Stock			
Duke Power—208,321 sh (being offered commonholders on 1-for-20 basis, record Sept. 2 to expire Sept. 18 without underwriting)	$6,250	$30.00	5.00%
SCHEDULE FOR SEPTEMBER—OCTOBER			
Bonds			**Bid Date**
Crawfordsville, Ind—electric revenues 1956-74	$1,350	.....	Sept. 8
Public Service of New Hampshire—1st mtg due 1983	7,000	.....	Sept. 14
Louisiana Power & Light—1st mtg due 1983	12,000	.....	Sept. 16
Duquesne Light—1st mtg due 1983	12,000	.....	Sept. 22
Richmond, Ind—electric revenues 1954-84	6,000	.....	Sept. 23
Indiana & Michigan Electric—1st mtg due 1983	15,000	.....	Sept. 29
Mississippi Power—1st mtg due 1983	4,000	.....	Oct. 6
Kansas Gas & Electric—1st mtg due 1983	10,000	.....	.....
Debentures			
Central Hudson Gas & Elec—conv debs due 1963	$6,000	.....	Sept. 9
Preferred Stock			
Duquesne Light—100,000 sh $50 par	$5,000	.....	Sept. 17
Kansas Gas & Electric—50,000 sh $100 par	5,000(a)	.....	.....
Indiana Michigan Electric—70,000 sh	7,000(b)	.....	.....
Common Stock			
Central Hudson Gas & Electric—139,978 sh (to be offered commonholders on 1-for-15 basis, record Sept. 9 to expire Sept. 25)	.....	.....	.....
Pacific Gas & Electric—1,946,829 sh (to be offered commonholders on 1-for-7 basis, record Sept. 15 to expire Oct. 6)	.....	.....	.....
Central Illinois Public Service—350,000 sh	.....	.....	Sept. 9
Duquesne Light—150,000 sh (c)	.....	.....	Sept. 15
New York State Electric & Gas—337,118 sh (to be offered commonholders on 1-for-8 basis, record Sept. 17 to expire Oct. 5)	.....	.....	.....
New England Gas & Electric—194,916 sh (to be offered commonholders on 1-for-10 basis, record about Sept. 30)	.....	.....	.....
Hartford Electric Light—105,500 sh (to be offered commonholders on 1-for-8 basis)	.....	.....	.....

Notes—(a) Company asks Federal Power Commission approval to sell the stock privately; (b) First Boston Corp-Union Securities Corp will sell the stock to institutions; and (c) In addition 34,739 shares will be sold by Standard Power & Light Corp.

sons bearing on its decision as to the rate of return.

It went on to say, "We have no desire to substitute our judgment for that of the commission, and therefore we have no occasion to set out what we feel would be a fair rate of return. What is of importance is that we are unable from the reported findings to arrive at a reasoned conclusion that the 5½% rate of return allowed by the commission is 'just and reasonable.' The commission has not sufficiently explained why it considers that rate reasonable, other than it provides a yield to the common stock owners of Northern comparable or greater amounts than those yielded by other natural gas companies. Against that consideration, we find the following in the record (of which there is no mention in the commission's opinion):

"1. Voluminous testimony, both oral and written on behalf of the petitioner, tending to show that a 6% rate of return is the absolute minimum rate which would provide a return which would be 'just and reasonable'.

"2. The finding of the presiding examiner, who conducted the hearing in question, as follows:

"Insofar as Northern and the staff differ as to the particular import of the factors to be included in the consideration of the earnings price ratios, the extent of market pressure, and the trends of the interest costs, and the dividends paid on outstanding securities, all factors from whatever basis must be considered in determining what is a fair rate of return which ultimately is a judgment determination.

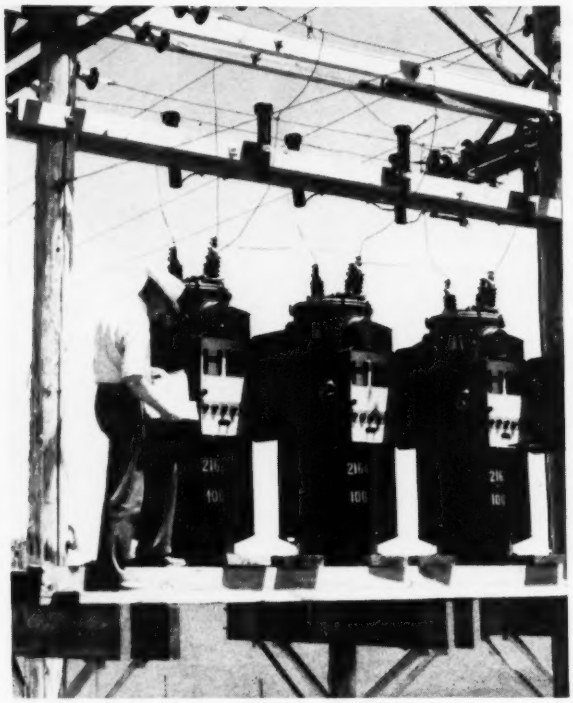
"3. The testimony of the expert witness called by the FPC, who gave a detailed explanation why he thought 6% should be the maximum return, and then gave figures showing that 5¾% might be adequate.

"4. The fact that no witness, as far as our examination of the record discloses, testified to a rate as low as 5½%.

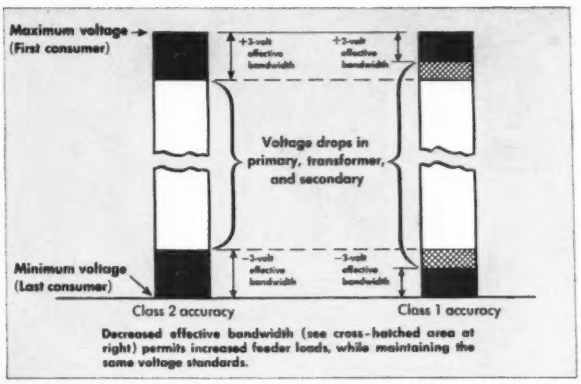
"A mere assertion that the commission has examined 'all of the available evidence of record on this subject' does not suffice to show this court, on review, that the conclusion of the commission as to the rate of return is the result of the application of the commission's expertise and judgment so that we would affirm."

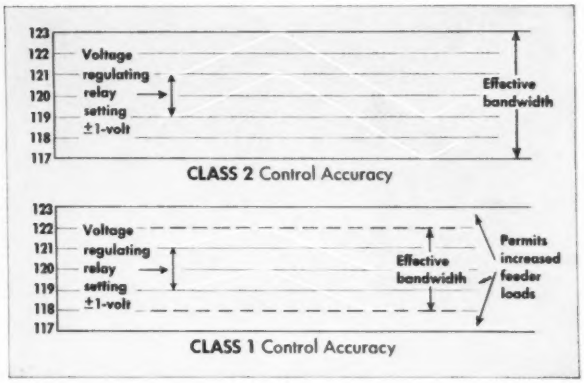
Reaffirms Earlier Court Decisions . . . It, in effect, reaffirmed many of the

(*Continued on page* 161)



GENERAL ELECTRIC TYPE ML32 voltage regulators provide better regulation on this branch line.


Maximum voltage
(First consumer)
+2-volt effective bandwidth
+2-volt effective bandwidth
Voltage drops in primary, transformer, and secondary
Minimum voltage
(Last consumer)
−2-volt effective bandwidth
−2-volt effective bandwidth
Class 2 accuracy
Class 1 accuracy
Decreased effective bandwidth (see cross-hatched area at right) permits increased feeder loads, while maintaining the same voltage standards.



Smaller effective bandwidth of voltage regulators permits increased feeder load-carrying ability

Class 1 accuracy controls of all G-E liquid-immersed feeder voltage regulators are important factor in reducing effective bandwidth

Voltage limits actually held at the output terminals of a feeder voltage regulator are referred to as effective bandwidth. One reason the effective bandwidth may exceed the bandwidth setting of the voltage regulating relay is the effect of control accuracy. Changes in temperature and frequency and errors in the potential transformer, current supply, or line-drop compensator elements act to increase the effective bandwidth of a regulator above the relay setting.

Hence, control accuracy is the key to reducing the effective bandwidth and, thus, increasing the load-carrying ability of a feeder.

The diagrams show how a reduction in effective bandwidth permits either lengthening a feeder to pick up more load or increasing the load over the existing line, while maintaining the same voltage standards for first and last consumers.

All G-E regulators, feeder- and station-type, are furnished with Class 1 accuracy controls as standard. Reducing effective bandwidth is important to you because of the obvious advantages of increased loadings or longer feeders. For full details on what Class 1 control accuracy of G-E regulators can mean to your system, contact your nearest G-E sales office, agent or distributor, or write for bulletin GEA-5690 to General Electric Company, Section 423-3, Schenectady 5, New York.

1879 75 1953 YEARS OF ELECTRICAL PROGRESS

You can put your confidence in—

GENERAL ELECTRIC

DISTRIBUTION TRANSFORMERS

different from others because.....

....Bushing terminals handle both Cu and Al

retard corrosion... prevent loosening due to "cold-flow" and temperature changes

Whether you use copper or aluminum conductors, General Electric distribution transformers meet your needs — thanks to new terminals which handle both copper and aluminum without special fittings.

HIGH-VOLTAGE BUSHINGS mounted on tank wall have a stainless-steel follow-up spring bearing on an extra-large serrated contact surface, which securely grips the conductor and breaks down aluminum oxide. The spring maintains pressure on the conductor, even when "cold-flow" or temperature changes occur.

LOW-VOLTAGE BUSHINGS and high-voltage cover bushings, which feature Strenicor pressure terminal clamps, have two stainless-steel, coned-disc spring (Belleville) washers. These washers maintain pressure on the conductor in the same manner as the spring in the high-voltage tank-wall bushings.

ALL BUSHING HARDWARE is tin-plated to retard corrosion.

REMEMBER . . . all transformers are not alike . . . compare the General Electric plus features in the chart below and see for yourself.

For more information on distribution transformers, either unit-type or conventional, contact your nearest G-E Sales Office or agent, or write to General Electric Company, Section 431-12, Schenectady 5, New York.

You can put your confidence in—

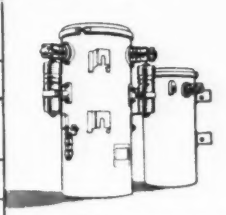
GENERAL ELECTRIC

ALL TRANSFORMERS ARE NOT ALIKE

(make this simple comparison and see)

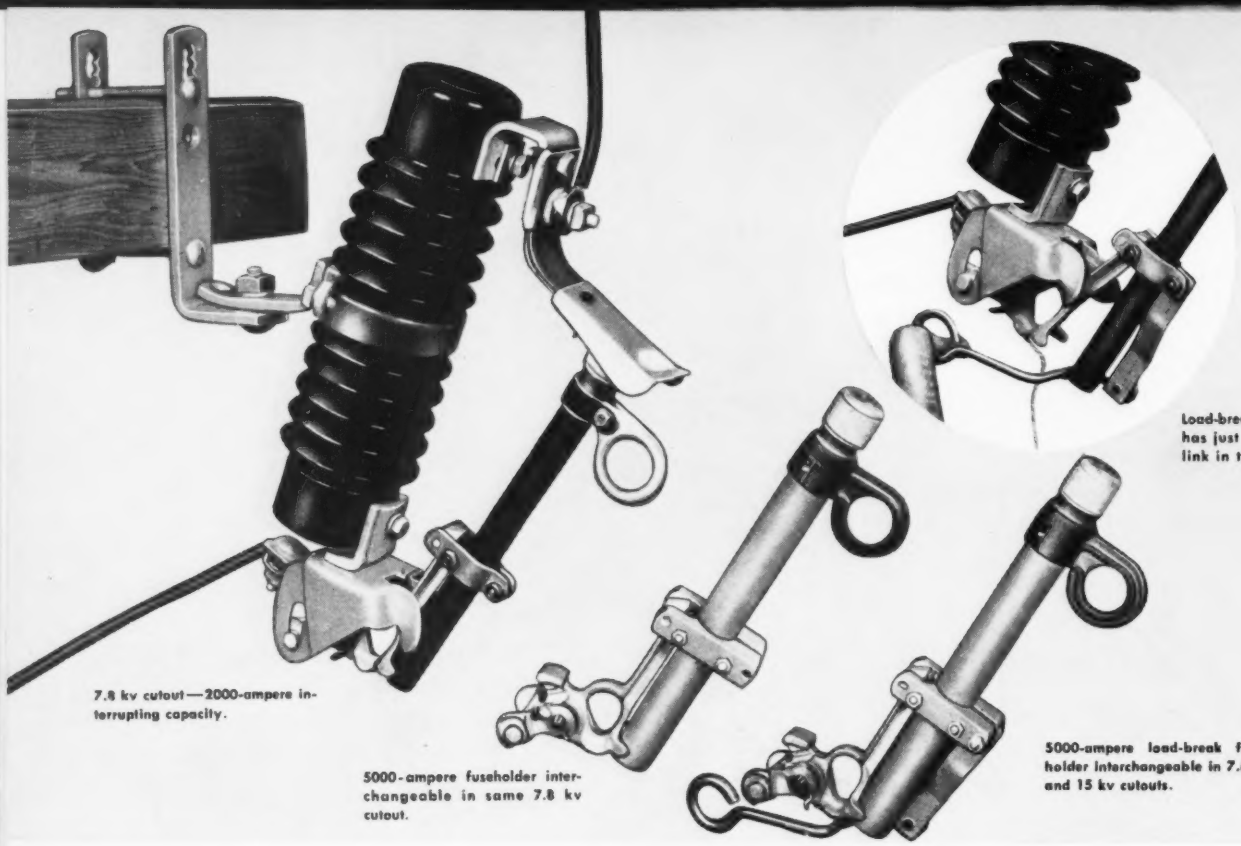
FEATURE	General Electric	Mfr. A	Mfr. B	Mfr. C	Mfr. D	Mfr. E
Production-line impulse testing	YES	NO	NO	NO	NO	NO
Nitrile rubber gaskets at all tank openings	YES	NO	NO	NO	NO	NO
Strenicor pressure terminal clamps	YES	NO	NO	NO	NO	NO
Insulated clamp-type connectors on tank wall hv bushings	YES	YES	YES	NO	YES	YES
One-piece cover band	YES	NO	NO	NO	NO	YES
Terminals designed for both copper and aluminum conductors	YES	NO	NO	NO	NO	NO
Gapped valve-type arresters	YES	NO	NO	NO	NO	NO
Nationwide company-operated service facilities	YES	YES	NO	NO	NO	YES

1879 75 1953 YEARS OF ELECTRICAL PROGRESS



UNIT-TYPE CONVENTIONAL

"Take your choice G. E. makes both"



7.8 kv cutout—2000-ampere interrupting capacity.

5000-ampere fuseholder interchangeable in same 7.8 kv cutout.

Load-break fuseholder has just broken fuse link in this close-up.

5000-ampere load-break fuseholder interchangeable in 7.8 kv and 15 kv cutouts.

NEW G-E OPEN DROPOUT CUTOUT

For FAULT PROTECTION—standard or heavy duty and LOAD BREAK—up to full load at any power-factor.

New simplified design of General Electric 7.8 kv and 15 kv, 100-ampere cutouts have these extra features:

Birdproof Construction accomplished by unique method of clamping the mounting support to the opposite side of insulator from live parts.

Liberal electrical and mechanical strength. New hollow tube wet process porcelain has under-cut petticoats for generous creep and strike distance; and porcelain insert fired within tube provides inside solid barrier between top and bottom live parts. Screen prevents insect nest within porcelain. Clamping U-bolt around porcelain is insulated with molded polyvinyl chloride having excellent insulating and weathering characteristics.

Compression bolting to porcelain—top and bottom fittings are bolted to insulator with porcelain under compression—for maximum mechanical strength. Compression clamps inside the porcelain maintain tight assembly.

Shielded top contact and latch—by roof-shaped contour and having ball-point contact surface to top of fuseholder, the top contact and its latch are protected from dirt deposits and sleet.

Other distinctive features are retained: Hinge guides allow slamming fuseholder from any angle; threaded cap seal at upper end of fuseholder forces expulsion gases downward; silver-plated contacts shielded from corrosive agents; vertical or angle-tilted swivel mounting with EEI-NEMA bracket; latch provides time-delay opening—assures fault current interruption before dropout action occurs; fuseholder tube of fiber and fabric-base Textolite* is water resistant, will not warp or split; close coupling of fuseholder to porcelain prevents multiplication of recoil forces.

For more information on these new open cutouts, contact your nearest G-E Sales Representative, or write to General Electric Company, Section 433-4, Schenectady 5, New York.

1876 75 1951 YEARS OF ELECTRICAL PROGRESS

*Reg. trade-mark of General Electric Company

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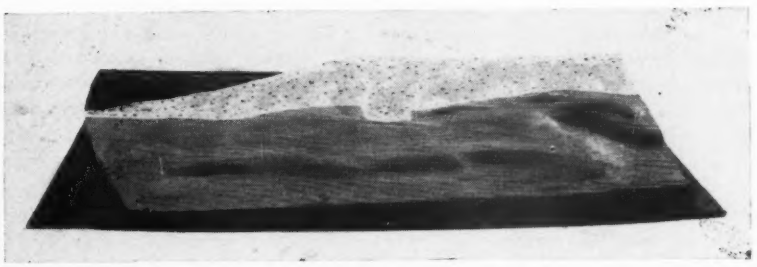
Relief Model Simplifies Substation Grading and Location

M. C. GALIYANO, Project Engineer, Station Electrical Engineering Div, Pennsylvania Power & Light Co, Allentown, Pa.

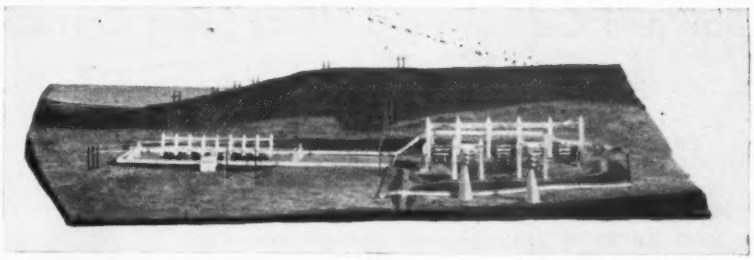
Topographical and substation models simplified complex grading and location problems at Pennsylvania Power & Light Co's new 220-66-kv Lycoming Substation. Substantial savings resulted because engineers were able to determine the most economical locations for initial and future installations of access roadways, yard grades and drainage, and modifications to standard structures.

A substation site, having a slope of 17 ft per 100 ft, was selected because of line construction, flood protection, grading, site availability, and suitable access. After the site was surveyed and the contour plan plotted to 1 in. equals 50 ft a relief model of the site was made in PP&L Co's model shop.

Topographical model was constructed of 1/20-in. show-card boards. Each board was cut for a particular elevation contour in 2½-ft steps, to maintain a scale of 1 in. equals 50 ft both vertically and horizontally. Cards were then stacked in their proper order, and a plastic compound was applied to provide the intermediate contour edges of the cards.



TOPOGRAPHICAL MODEL was made from showcard boards that were cut for different contours, stacked in proper order, and step surface smoothed with a plastic compound



COMPLETED SUBSTATION LAYOUT was made by modifying relief model for excavation and fill, and adding scaled models of switching structures, transformers, fencing, etc

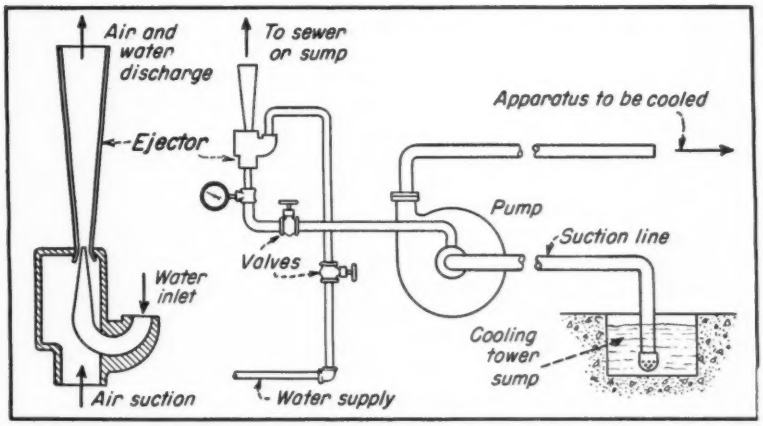
Scale models of switch structures and yard areas were made and tentatively spotted on the relief model for location. After numerous studies of the contour plan in conjunction with relief model, definite location and grade for the various switchyards were determined. The relief model was then modified for excavation and fill to include the switching structures, transformer, roadways, etc, resulting in a complete substation layout.

Air Ejector Primes Circulating Water Pump

H. A. DILBERGER, Engineer of Substations, East Bay Division, Pacific Gas & Electric Co, Oakland, Calif.

Positive priming of centrifugal pumps in cooling water systems of transformers, regulators, bearings, etc, may be done easily and quickly through use of a water-jet air ejector. The method is most beneficial in cooling systems where suction in long sump lines normally is lost between operations of the pump.

Original cost and installation of air ejector, two valves, and piping, where water is available and pipe runs are not too long, will be about $95. Air ejector is simply a venturi tube and



WATER-JET AIR EJECTOR primes centrifugal pumps in cooling water system easily and quickly. To install ejector, it is necessary to tap pump casing and run line to city water supply

nozzle (see accompanying diagram) which establishes a vacuum when a jet of water is passed through nozzle at high velocity.

To install the ejector it is necessary to drill and tap a hole for a ½-in. pipe in suction side of pump casing as near to runner wheel as possible. Vacuum side of ejector is connected to this pipe with vacuum gage and valve. Connection from city water supply is made to inlet side of ejector with valve and 1-in. pipe; discharge line is run to nearest sewer or floor drain. With 60-psi water pressure, a 29-in. (water) vacuum has been attained.

In priming the pump, this procedure is followed. After pump has been started in normal manner but does not pick up pressure, valve to city water supply is opened. When ejector has developed a vacuum, valve to pump casing is opened. Within 30 sec or so vacuum in sump line will build up and water pressure will rise to normal value.

Ejector should remain in operation for several minutes after cooling water begins to flow to expel any "slugs" of air entrapped in sump line. Valves to city water supply and pump casing normally are closed when ejector is not operating.

Operating experience with ten installations of air ejectors has suggested these procedures:

1. If water used in ejector is less than make-up water for cooling system, ejector may be left in continuous operation and its discharge water carried to cooling water sump.

2. Foot valve in sump and all air vents in pump housing and in suction line may be removed.

3. Because normal small leaks around packing gland do not affect priming, it is not necessary to tighten gland before each priming operation.

4. In locations where available water pressure may be low, a ½-hp auxiliary motor-driven pump with circulating tank may be installed in ejector piping to establish proper vacuum.

Soil and Galvanizing Affect Steel Corrosion

Underground corrosion of hot-dipped galvanized steel pipe is a function of the type of soil and quantity of galvanized coating. The National Bureau of Standards reports from recent tests that 3 oz of zinc per sq ft of exposed surface is highly resistant to corrosion in many soils that are very corrosive to bare steel.

Short lengths of galvanized and uncoated steel pipe were buried at 15 test sites representing a wide range of soils for periods up to 13 years. After each of five periods of exposure, a set of specimens was returned to NBS laboratories where corrosion products were removed. Determinations were made of weight loss, depth of deepest pits, and percentage of the galvanized specimens' area that remained coated.

Nominal weight of zinc on all coated specimens was 3 oz per sq ft, although actual thickness varied over a wide range. This was shown by thickness measurements made on a large number of samples from the same pipe lot as the buried specimens. Additional determinations by an electrolytic stripping method showed that a large part of zinc that was applied to steel pipe was converted into alloys of zinc and iron.

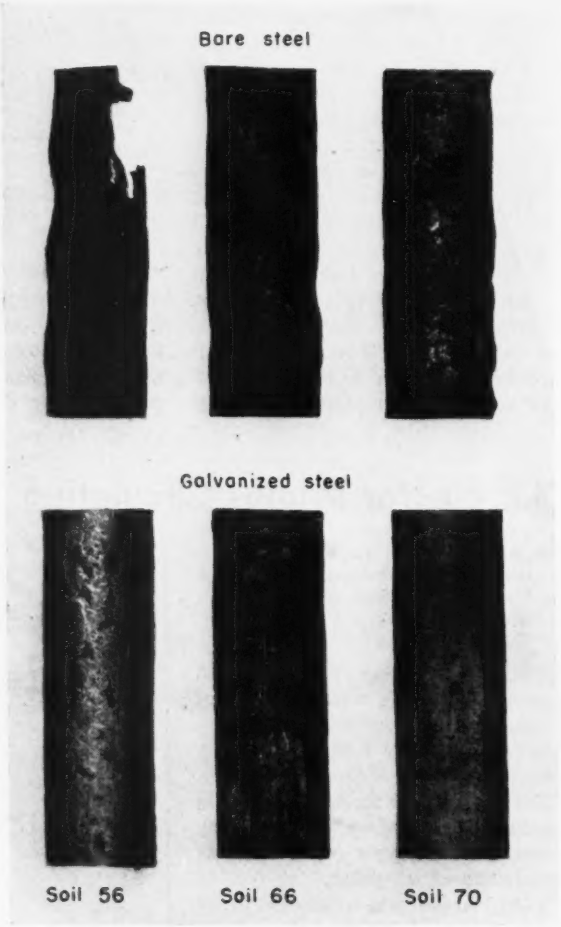
Zinc coatings provided good protection in most soils. In only two of 15 soils, both organic, was zinc coating of negligible protection. Further, it was found that to protect steel for a minimum of 10 years the following coatings are needed:

1. A 2-oz coating is required in inorganic oxidizing soils.

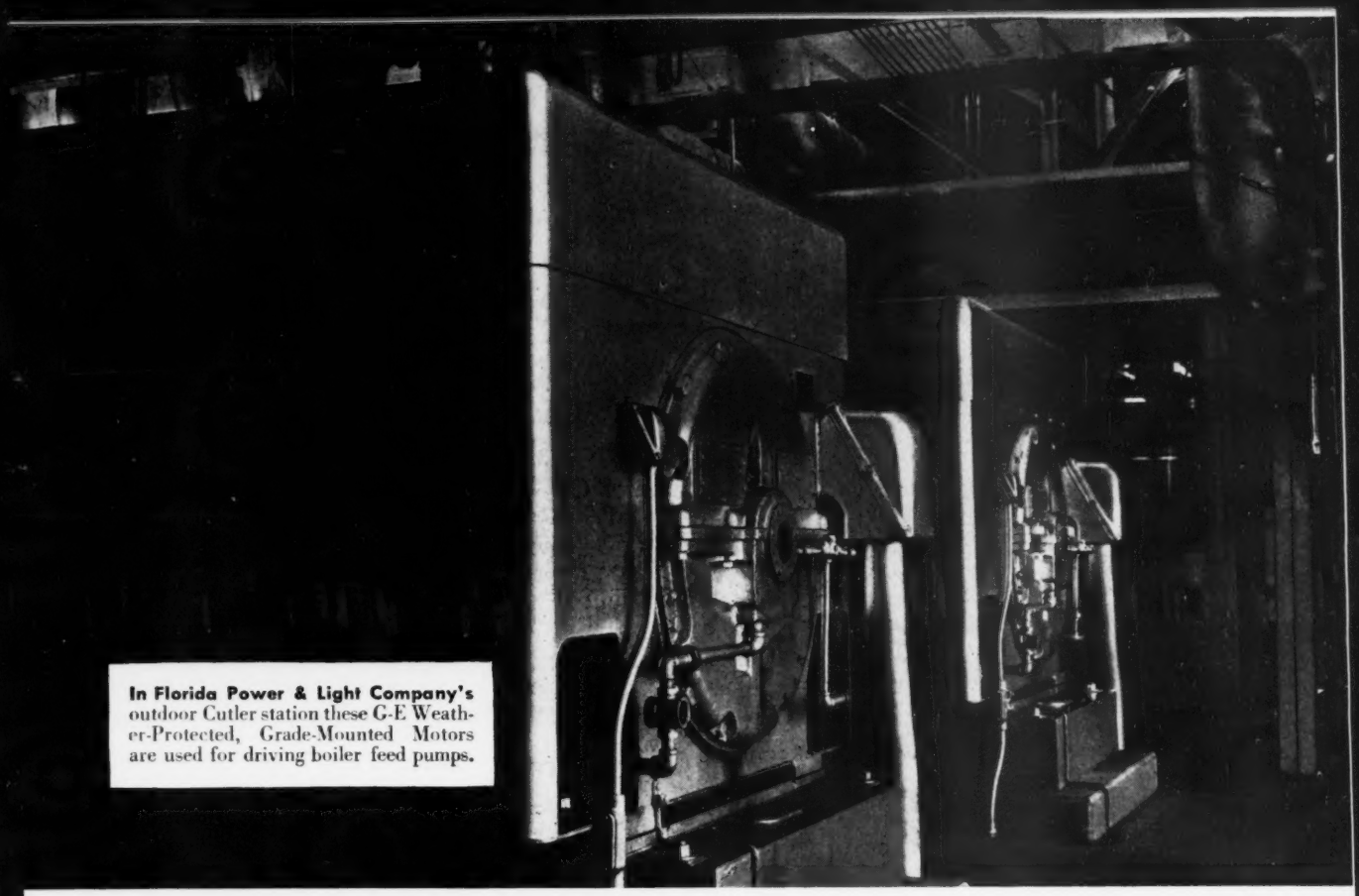
2. A 3-oz coating is required for inorganic moderately reducing soils.

3. Coatings heavier than 3 oz per sq ft are required for highly reducing soils, both organic and inorganic.

Another finding of the tests was the high corrosion resistance that galvanized specimens continued to show in most soils after outer zinc coating, and even after zinc-iron alloy layer, had entirely corroded away. Continuing protection is tentatively attributed to an inorganic coating, probably silicious, believed to be deposited by galvanic action between zinc coating and underlying steel layer.



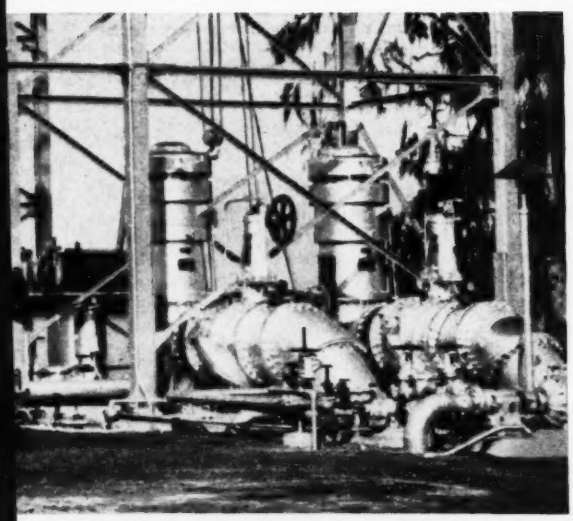
TYPICAL SPECIMENS of bare steel pipe (top illustrations) and galvanized steel pipe (bottom illustrations) after 13 years of exposure to corrosion in three different soils. Specimens that are directly above and below each other were buried in the same soil



In Florida Power & Light Company's outdoor Cutler station these G-E Weather-Protected, Grade-Mounted Motors are used for driving boiler feed pumps.

Designed specifically for outdoor, all-weather applications . . .

G-E Weather-protected Motors Provide Vital Continuous Service



G-E Weather-Protected Vertical Motors coupled to circulating water pumps operate outdoors in all weather at Florida Power & Light Company's Palatka Station.

Here's a low cost motor that the weather can't stop. For vital outdoor power station service, you can always count on reliable performance from rugged G-E Weather-Protected Motors . . . in all kinds of weather. An extremely effective ventilating system minimizes entrance of rain, snow, sleet and other airborne particles. Windings and other internal parts stay dry . . . assure you of dependable, all-weather service at minimum installed cost.

You get another big plus from industry's first successful outdoor weather-protected motor . . . the long-life quality developed in building over 2½ million horsepower of motors for power stations.

For complete information on these and many other features, contact your nearest G-E Apparatus Sales Office or write for Bulletin GEA-5810. General Electric Co., Section 753-5, Schenectady 5, N. Y.

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Apply Operating Practices for Savings

This check list can serve as a guide to operating practices that have brought savings to companies using the practices. The list is offered as an idea stimulator and thought provoker. Items are selected from a list compiled by E. W. Robinson,* vice-president and general manager of Alabama Power Co

SYSTEM OPERATIONS

Yes No

- ☐ ☐ 1. Do you schedule unit outages to obtain lowest cost and greatest reliability or optimum combination of these?
- ☐ ☐ 2. Have economic studies been made concerning causes of interruptions and curtailments of generating capacity for your system?
- ☐ ☐ 3. Are you justifying additions, improvements and changes in practice by system studies?
- ☐ ☐ 4. Have you a program for revision of distribution sectionalization and fuse coordination to keep pace with changing requirements?
- ☐ ☐ 5. Does your voltage testing program take into account cost, revenue and quality of service?
- ☐ ☐ 6. Have you developed a set of standards for quality of service to secure an optimum balance of adequacy, costs, and public relations?
- ☐ ☐ 7. Are the interplant and intraplant communications designed to reduce operation and to secure good economy on your system?
- ☐ ☐ 8. Do you use multiple purpose capacitor couplers for communications and relaying to reduce costs and complications at generating stations and substations?
- ☐ ☐ 9. Does your method of distribution mapping avoid excessive costs and at the same time satisfy requirements?
- ☐ ☐ 10. Have you considered conversion of attended or partially attended substations to automatic operation or remote control?

CONSTRUCTION

- ☐ ☐ 1. Do your design and construction practices reflect corrosion preventive measures?
- ☐ ☐ 2. Have you considered contracting certain jobs as a meas n of reducing expenditures?
- ☐ ☐ 3. Are you using the best combination of trimming, tree wire, cable, higher poles, rerouting and other methods to deal with tree interference?
- ☐ ☐ 4. Have studies of forms and procedures been made to eliminate unnecessary work?
- ☐ ☐ 5. Do you continually examine new developments and availability of materials and equipment as a guide to substitution for minimum costs?
- ☐ ☐ 6. Do you study designs and construction projects to secure the optimum performance at the lowest cost?
- ☐ ☐ 7. Have you considered using sprayed metal in maintenance work?
- ☐ ☐ 8. Are you minimizing disposal costs and deriving the full benefit of fly ash by developing uses for it?
- ☐ ☐ 9. Have you analyzed the causes of failures and interruption of distribution facilities to improve construction?
- ☐ ☐ 10. Have you considered revision of forms and procedures for authorizing new business connections to reduce work and cost of preparation and handling?

EQUIPMENT

- ☐ ☐ 1. Does your generator loading schedule take into consideration the over-all economy of all generators with their transmission connections?
- ☐ ☐ 2. Have you considered using autotransformers instead of two winding transformers for certain jobs?
- ☐ ☐ 3. Do you use phase-shifting transformers to gain the optimum loading of transmission lines?
- ☐ ☐ 4. Is your program for checking transformer loading adequate? Does it take into account cost, failures, reduced life and quality of service?
- ☐ ☐ 5. Are you replacing and shop testing watthour meters by groups rather than individual field testing?
- ☐ ☐ 6. Do you have a definite program for retiring and junking obsolete equipment which is responsible for higher operating costs and poorer service?
- ☐ ☐ 7. Do you evaluate fuel prices and characteristics, and reflect the results in specifications and purchasing?
- ☐ ☐ 8. Have you perfected pole and transformer handling equipment and procedures so as to avoid interrupting crews?
- ☐ ☐ 9. Do you have a study program for new developments in materials and equipment?
- ☐ ☐ 10. Have you investigated supplemental cooling of older equipment to increase the rating?

PERSONNEL

- ☐ ☐ 1. Have you considered decentralized vs centralized substation maintenance personnel and facilities?
- ☐ ☐ 2. Do you use small or split crews for certain operations?
- ☐ ☐ 3. Are your warehouses and crew headquarters provided with facilities and personnel to load crew trucks outside working hours, thus avoiding loss of crew time?
- ☐ ☐ 4. Have you defined the conditions under which some use of overtime is advantageous?
- ☐ ☐ 5. Have you tried to minimize overtime through studies of organization, equipment, and methods?
- ☐ ☐ 6. Do you require supervisors to spend time in the field in contact with operations so that they know prevailing conditions and personnel problems?

*Adapted from a recent Southeastern Electric Exchange paper

IN THE MANUFACTURING CYCLE ALL G-E I-50 METERS PASS 18 ELECTRICAL TESTS AND 356 POINTS OF INSPECTION . . .

Precision Quality-control in Manufacture Assures Accuracy of Certified I-50 Meters

General Electric I-50 watthour meters can be certified for accuracy and performance only because of a completely new design. This design embraces new methods of construction, new materials, and—of prime importance—new manufacturing techniques.

LATEST METHODS of quality control are major contributing factors in the certification of I-50's. This precision control of quality makes it possible to factory certify that more than 99.9% I-50 meters are free from defects that might cause improper registration or operation.

DURING MANUFACTURE each I-50 passes a rigid inspection and testing schedule. In final inspection every meter passes 54 separate points of inspection before receiving the "gold seal of certification"—your assurance of an accurate and dependable meter.

For more information, see the color movie, "Accent on Accuracy." Call your nearest G-E representative or write General Electric, Schenectady 5, N. Y.

601-99

REGISTER RATIO is precision checked on special test stands where each register is spun rapidly and compared with standard.

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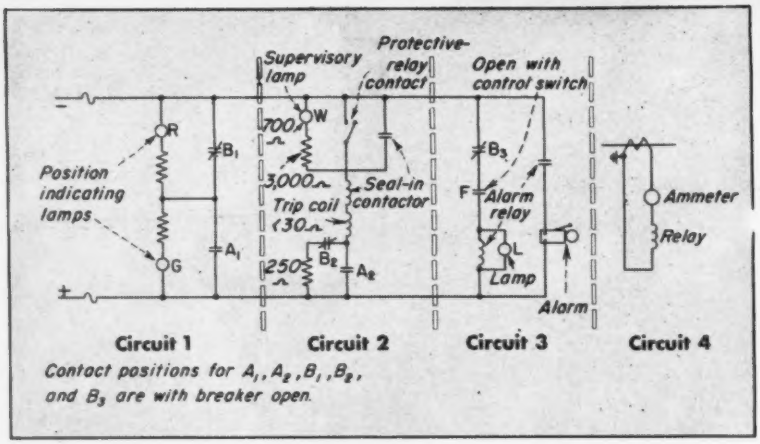
FLOATING DISCS are individually inspected on an oscilloscope to detect any magnetic particles or foreign matter.

FINAL HIGH-POTENTIAL TEST of each I-50 watthour meter is at 3000 volts—several times higher than industry requirements.

QUALITY-CONTROL stations, maintained by laboratory, act as double-check on 356 inspections which every I-50 must pass.



CONTROL SYSTEM for indication and supervision gains reliability by segregation of circuits

Control System Provides Position Indication and Circuit Supervision

IRVING D. PERRY, Electric Engineering Dept, Public Service Electric & Gas Co, Newark, N. J.

A continuously-supervised and positive equipment position indicating control system that comprises four separate control circuits energized through relay contacts, and for use with switchgear, has been developed by Public Service Electric & Gas Co. Objectives are these:

1. To insure the correct performance of equipment during normal operation and when there is a fault on the system, the exact position of oil circuit breakers and disconnect switches must be accurately known by station operators.

2. To insure the correct functioning of equipment during all faults, supervision must be provided for the protective equipment circuits.

But the functions of position indication and circuit supervision cannot satisfactorily be combined. Placing the closed position indicating light across protective relay contacts for supervision will give an incorrect breaker position indication if relay and breaker do not function correctly during a fault.

To overcome that situation, the four individual circuits were designed. Circuit 1 is for position indication of oil circuit breakers and disconnect switches. Equipment functions as follows: Closed correctly—red light; open correctly—green light; mid-position—red and green lights half brilliancy; control circuit de-energized—no lights.

Circuit 2 is a supervisory circuit for tripping breakers. Normally when a breaker is to be opened with the trip coil, the protective-relay main contact is closed, then the supervisory white lamp is extinguished, the seal-in contactor is energized and closed, and the trip coil is fully energized through the A_2 auxiliary switch on breaker. This latter contact is closed when the breaker is closed.

When the protective relay is opened, the energized trip circuit is maintained and the supervisory light remains extinguished. After the breaker opens, auxiliary switch A_2 opens, auxiliary switch B_2 closes, 250-ohm resistor limits current to the seal-in contactor which opens, and the supervisory lamp is energized. This signals that the operation has been completed.

If breaker is to be tripped but does not open, auxiliary switch A_1 remains closed, trip coil remains fully energized, the seal-in contactor remains closed and the white lamp is de-energized. Dark lamp indicates non-operation of the breaker.

Circuit 3 shows signal circuit designed to indicate to station attendant that an automatic operation has occurred. When control switch contact F is closed and auxiliary switch B_3 is closed with automatic tripping of the breaker, the alarm relay and annuciator lamp are energized. At the same time the alarm relay contact is closed and the audible alarm is sounded.

Circuit 4 is a current transformer circuit supplying energy to protective relays and supervised by an ammeter.

Adapted from the author's paper, entitled "A Continuously Supervised and Positive Equipment Indicating Control System," presented before the recent Pennsylvania Electric Association Relay Committee Meeting at Newark, N. J.

Old Washing Machine Cleans Meter Covers Better

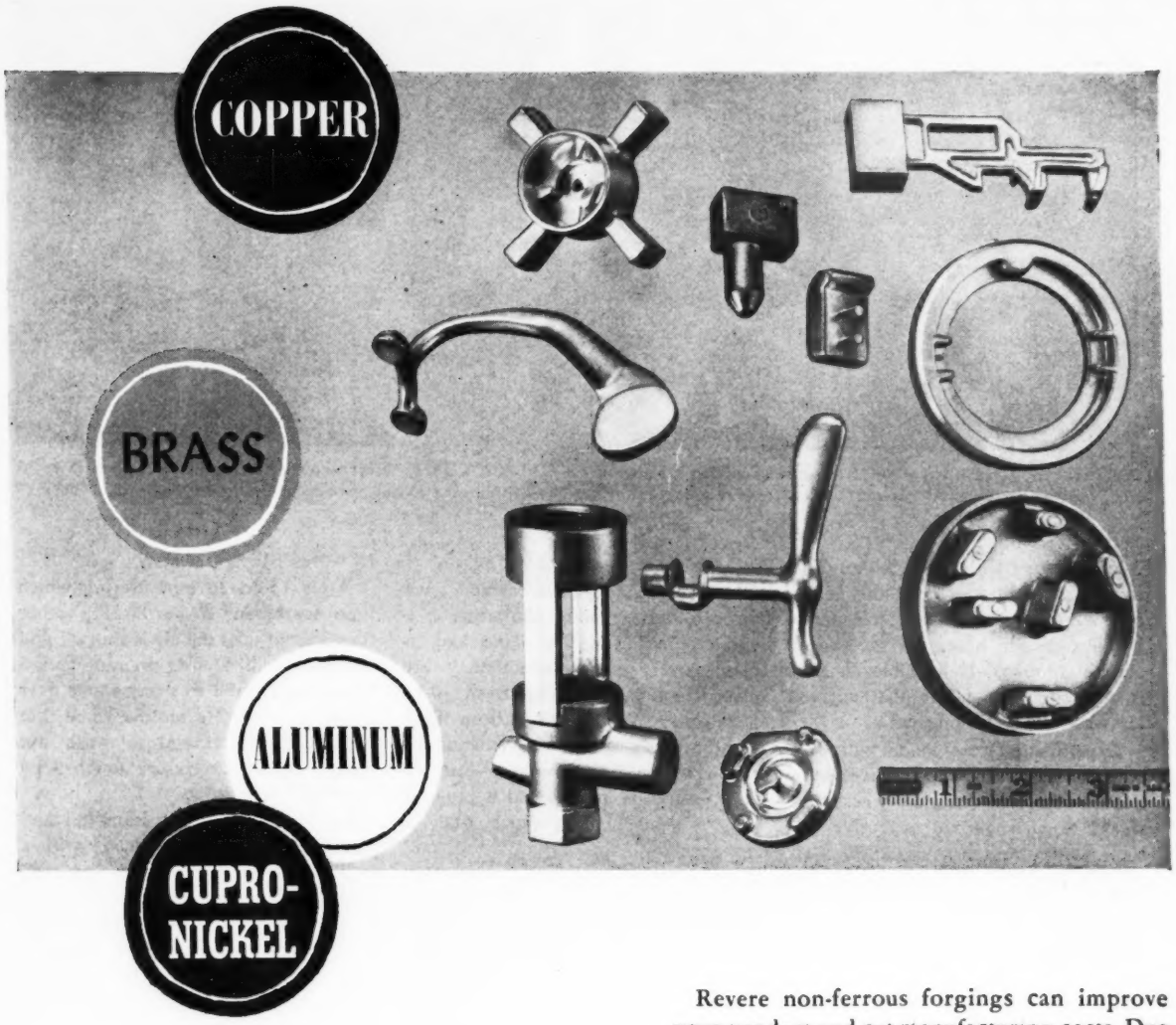
COPPER TUBING (⅜-in. diam) installed in coil on tub bottom has ⅛-in. holes 3 in. apart. Note metal plate covering holes on bottom left by removed washer parts

PHILIP F. JONES, Jr, P.E., Division Meter Supt, Georgia Power Co, Athens, Ga.

Meter glass covers are cleaned efficiently and inexpensively at Athens Division of Georgia Power Co. by use of a junked domestic washing machine, which was specially modified for this purpose. The tub is 21½ in. deep and 26 in. in diameter. Overall height is 33½ in. It has three legs equipped with ball casters and is easily rolled about the shop.

All of the mechanism was removed from the inside of the tub and a ⅛-in. metal plate was mounted in the bottom to cover holes left by removed parts. Drain pump and motor were left in tact for draining.

A piece of ⅜-in. copper tubing was installed in a coil on bottom with 3-in. spacings. This coil was perforated at



Revere non-ferrous forgings can improve your product and cut manufacturing costs. Due to high strength-weight ratios, weight reduction often is possible. Complex parts now assembled in several pieces may be forged in one piece. Dimensions are accurate, reducing machining time, scrap, rejects. Surfaces are good; small details such as names, trademarks and numbers can be held sharp. Being uniform in density and free from blow-holes, Revere Forgings are non-porous and will hold fluids and gases without leakage. It will pay you to get all the facts about forgings. See the nearest Revere Sales Office.

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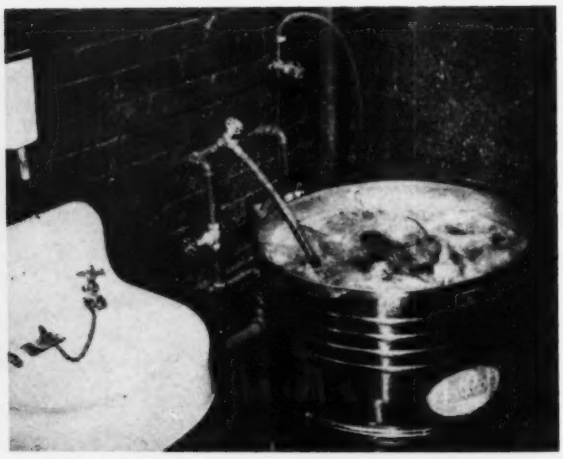
SEE REVERE'S "MEET THE PRESS" ON NBC TELEVISION, SUNDAYS

PORTABLE WASHER is easily rolled to meter unpacking table where it is filled with 30 to 36 covers, then rolled to washing location



"BOILING" COVERS in hot water cleaning solution requires 15 to 20 min. Air hose attached to tubing at tub bottom causes "boiling"

3-in. spacings with ⅛-in. holes. Tubing was brought to top of tub and to end was connected fitting for attaching flexible air hose. Air is used to agitate solutions. Detachable air hose is equipped with fitting that cuts off air when hose is removed.

Experiments were made with several cleaners, soaps and detergents. Some were too strong—others too weak. Some were too expensive and some had objectionable odors. Best cleaner was a concrete floor cleaner. Several manufacturers make such a product that does not sud. Odor is not objectionable and it is inexpensive.

Meters are unpacked and placed on table for checking numbers and types prior to testing and calibrating. Machine is rolled to the table and as glass covers are removed they are placed in tub. Tub holds from 30 to 36 covers. When tub has been filled with covers, it is rolled to washing location where drain hose is inserted into a soil pipe, motor lead is plugged into a convenience outlet that is equipped with an off-on switch, and filling hose is placed in tub. Two pounds of cleaner are sprinkled over covers and tub is filled with hot water. Air hose is attached and air adjusted to vigorously boil water.

After 15 to 20 min (during which time workman is performing other functions of test) the air is shut off and tub is drained. During draining period filler hose is used to spray water over covers as a rinse to remove scum that has come to top and to wash out cleaner before covers are touched by workman's hands.

Covers are removed from tub and rinsed by hand in warm water with a rag. Most all paints are removed with this operation. In stubborn cases some scraping is necessary, but with little effort since paint is softened.

Oversized Auger Digs Large Hole Quickly

About 5.5 "yards" of dirt are brought up from a hole in a few minutes by 54-in. auger. Device was specially designed for use by Idaho Power Co in digging holes for steel tower foundations. Auger mounts on shaft of regular hole-digging equipment and bores a hole 10 ft deep.

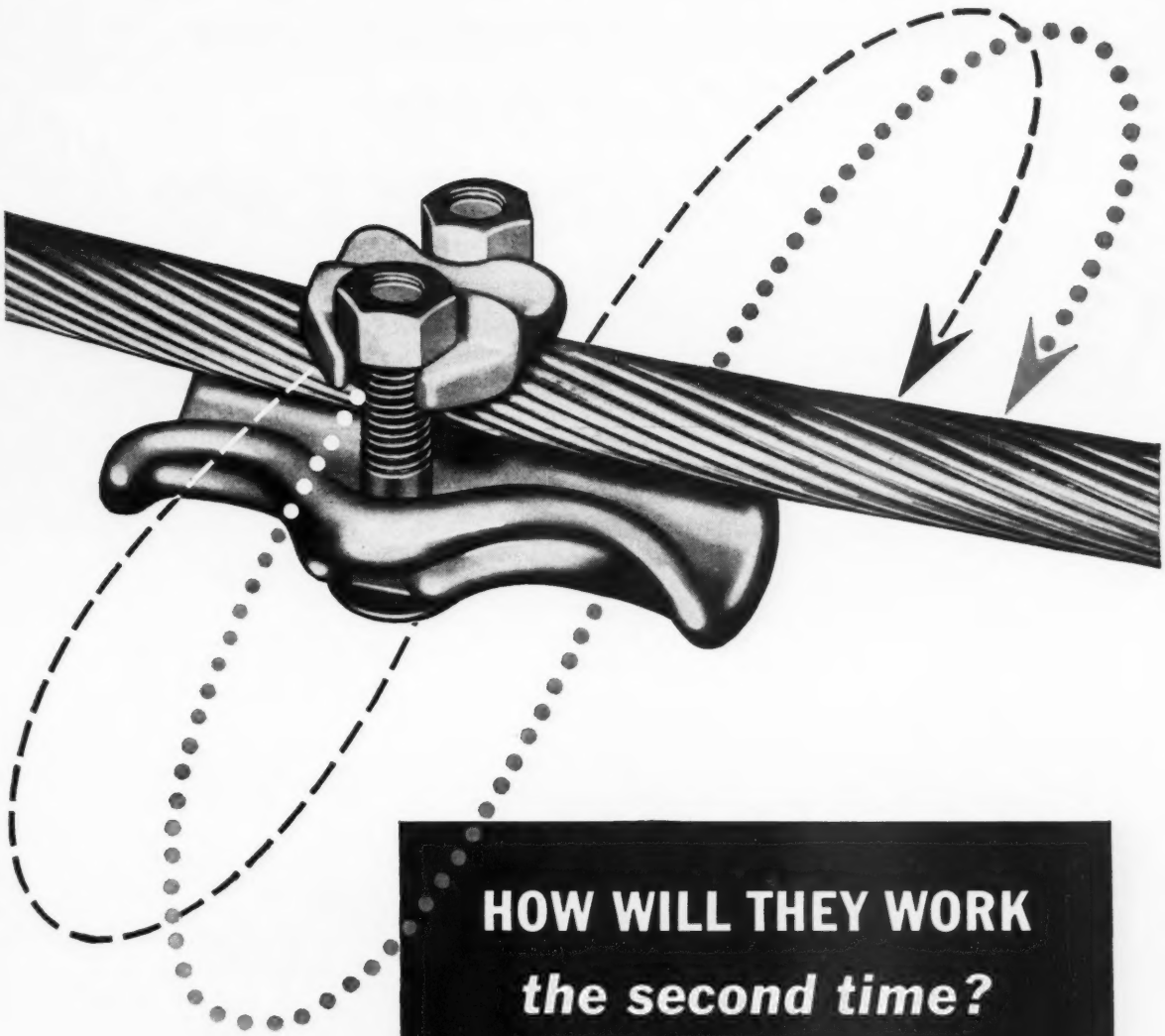
Container Extends Paint Brush Life

JOHN W. MASON, Substation Maintenance Dept, The Ohio Power Co, Cambridge, Ohio

Containers used by the Ohio Power Co for transporting paint brushes immersed in their solvents have extended brush life, and thus reduced high replacement costs. In addition, maintenance employees traveling from substation to substation can use and clean brushes in a minimum amount of time.

The 3-cell container permits three groups of paint brushes to be immersed in their required solvents when not in use. Its construction provides a splash-proof, leak-proof container suitable for turpentine, Dulux, Glyptal, 1500 M thinners or other solvents and linseed oil. Paintbrush handles may be drilled to slide

(*Continued on page* 114)



HOW WILL THEY WORK *the second time?*

Make sure you get a clamptop device that will re-assemble without trouble by choosing O-B. When released from the insulator, O-B clamps are free to slide along the conductor. Thus they can move back into perfect registration with insulators that are relocated as a result of maintenance or repair work.

That's why we suggest you ask yourself "How will they work the second time?" when you're choosing Clamptop Insulators. You know that conductors will be removed from some of them to rebuild crossarms, replace poles, or for change-outs. This will require clamps to be released and replaced.

With the easy re-alignment feature in O-B Clamptop Insulators you can be sure that clamps will register with insulators after change-outs or re-locations.

Ohio Brass

MANSFIELD OHIO, U.S.A.

IN CANADA: CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

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Build lines to stay with the CHANCE 8-Way

For best results, use the anchor that pushes *eight* blades into undisturbed earth all around the hole, with no wasted space between blades. This means complete, balanced load distribution.

Chance 8-way Anchors are available in a complete range of sizes from 60 to 200 square inches in area, for distribution or transmission line guying. Get full information today—consult your Chance Catalog—order from your regular supplier.

the CHANCE 8-WAY *gives full load distribution*

Anchor installations are *faster, easier* and *better* when line crews use the right tools. Chance tools are designed for efficiency and safety. The tools shown at right are what you need for expanding anchor installations.

1. Chance Combination Expanding and Tamping Bar. It hooks around the anchor rod and will not slip off.
2. Chance Telescoping Trip Auger—it bores like a bit, adjusts for various hole sizes, and has an easy dump trip.

Send for the Chance folder on the tools to use for better anchor installations.

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SAN FRANCISCO, CALIFORNIA

ANCHORS • GUYING FIXTURES • LINE CONSTRUCTION TOOLS • CONDUCTOR CLAMPS
GROUNDING EQUIPMENT • HOT LINE TOOLS • HIGH VOLTAGE SWITCHES • CUTOUTS

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NUMBER ONE OF A SERIES

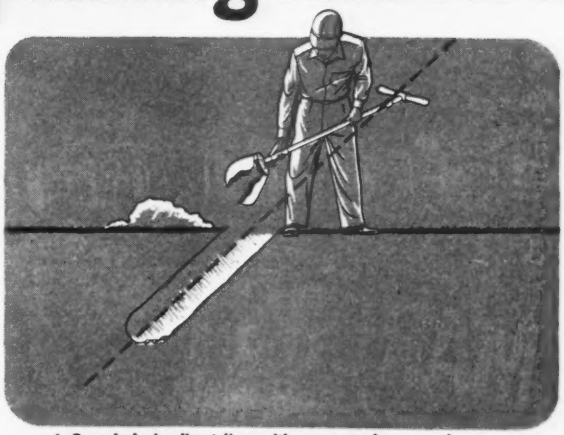
TIPS FOR BETTER ANCHORING...

How to install Expanding Anchors

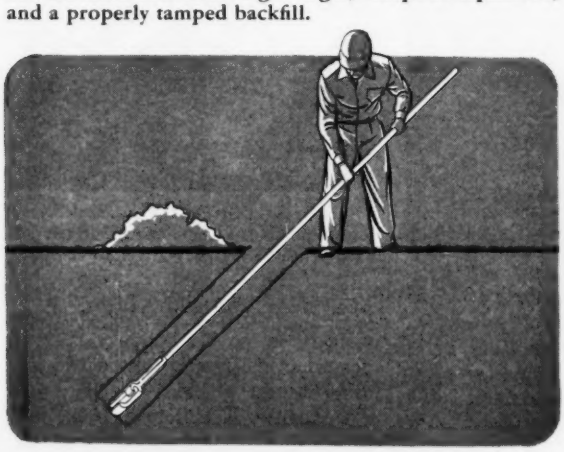
Good anchoring is cheap insurance against line disaster. Failures can be costly, and since the anchors cannot be inspected after installation, it is important that they be properly installed. Combining the best methods developed in years of field use with our 45 years of engineering development and testing experience, the A. B. Chance Company offers these suggestions for getting the most out of your anchors . . .

Expanding anchors may be used in any type of soil with the exception of hard rock, shale, extreme hardpan and, of course, swamps and marshes.

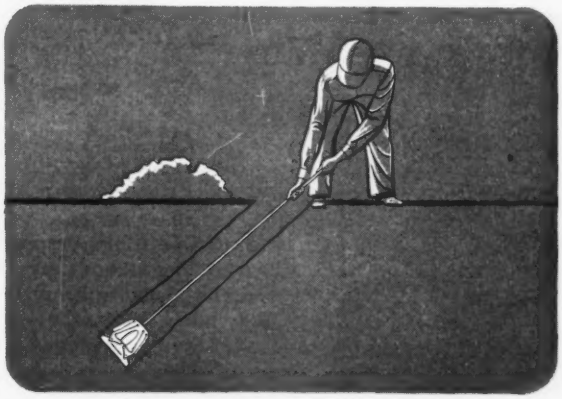
Merely dropping the anchor in the hole, throwing in the dirt, and piling it up in a little mound to allow for settling, is the easy—but ineffective way! An anchor so installed will not develop its rated holding power. The successful formula for a good expanding anchor installation is the correct sized hole at the right angle, complete expansion, and a properly tamped backfill.



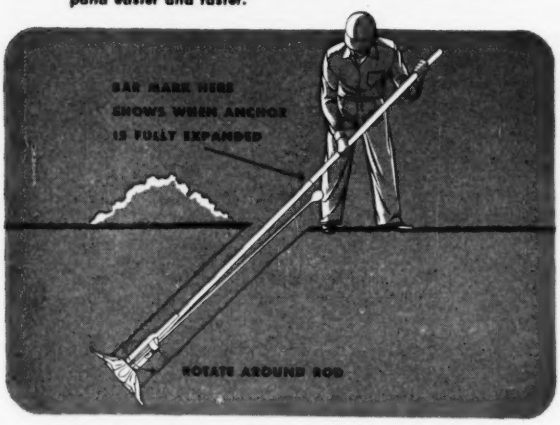
1. Bore hole in direct line with guy attachment, whenever practical. This prevents gradual slacking of the guy. Hole should be same diameter as anchor for greatest holding power.



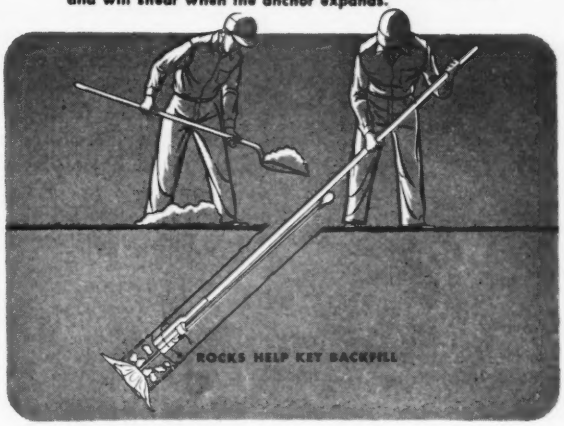
2. Tamp the bottom of the hole to square it off and give the anchor a good foundation. This helps the anchor to expand easier and faster.



3. Attach anchor to rod and push to bottom of the hole. *Do Not remove tie wires.* They help in placing the anchor and will shear when the anchor expands.



4. Expand the anchor with an expanding and tamping bar that hooks around the rod. Be sure that the anchor expands fully. A mark on the expanding bar will help.



5. Tamp backfill thoroughly with expanding bar hooked around anchor rod. Rotate bar during tamping to pack entire area. Use driest dirt for first 2 feet of fill.

Reprints of this advertisement for your bulletin board, or for distribution to your men, are yours for the asking—request Form 21, Expanding Anchors. Write A. B. Chance Company, Centralia, Mo.

Bank of 12 Transformers
Total Capacity 4000 KVA
Electrical Contractor:
RIGGS DISTLER & CO., INC.
Philadelphia, Pa.

Piasecki Helicopter Corporation, makers of two of Uncle Sam's most important helicopters—the 14-passenger Air Force Work Horse, and the 6-seat Navy HUP—has installed Marcus dry type Transformers to do the vital power job in their big new plant at Morton, Pa.

They were selected because every detail of the Marcus dry type transformer is engineered for long life . . . and continuous, trouble-free performance. Latest contribution pioneered by Marcus for greater transformer durability is Hi-Heat, Hi-Dielectric Magnet Wire, insulated with DuPont's newest miracle polyester film *"Mylar,"* combined with Johns-Manville *"Quinterra"* to reach insulation levels at least 10 times present industry standards.

Capacities from 1 to 3000 KVA

- DISTRIBUTION
- GENERAL PURPOSE
- UNIT SUBSTATION
- PHASE CHANGING
- ELECTRIC FURNACE
- RECTIFIER
- WELDING
- MOTOR STARTING
- SPECIAL

"Mark of Quality"

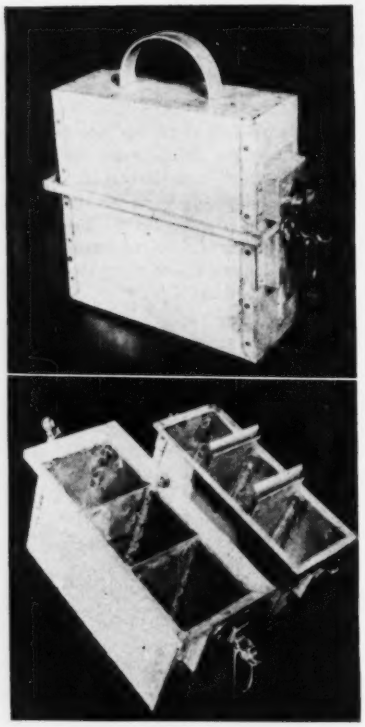
—MARCUS—
TRANSFORMER CO., INC.
HILLSIDE 5, NEW JERSEY

Representatives in Principal Cities

ONE OF THE WORLD'S LARGEST MANUFACTURERS OF DRY TYPE TRANSFORMERS EXCLUSIVELY

Paintbrush Container

(*Continued from page* 110)



THREE-CELL CONTAINER assembled for transportation and separated to show interior construction of top and bottom sections

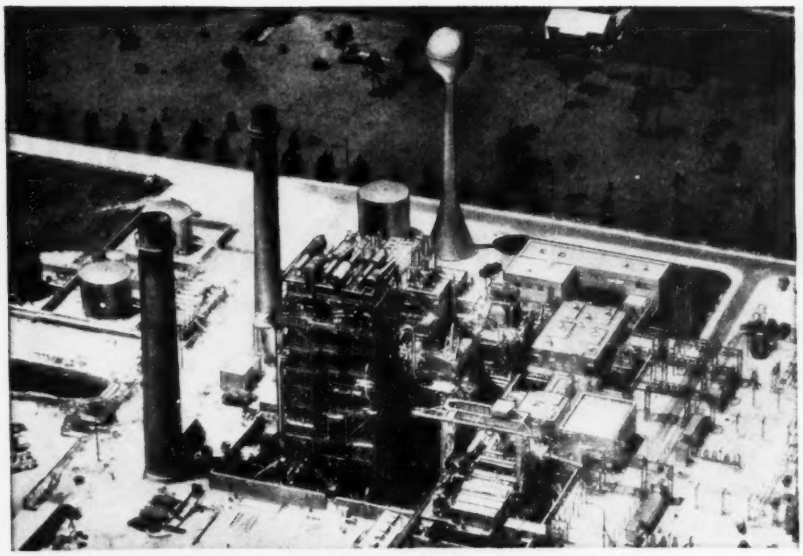
over a short rod wedged between dividers so the brushes may be suspended in the proper solvent without distorting the bristles.

Containers were fabricated in our shop from scrap metal salvaged during inclement weather when field maintenance work could not be conducted. Only the trunk locks, which cost $1.35 per pair, were purchased. About 8 to 10 man-hours were required to make one container, but the time would probably be reduced if more than one container is made by the same person.

The portable unit was made from 28-gage sheet metal. The latter was formed to provide a 5 x 9 x 5-in. bottom container with ½-in. cupped flange around the open side, and a 4¼-in. deep top section with 7/16-in. flat flange around open side to fit into the cupped flange. Outside overlapped joints are riveted and soldered.

Sheet-metal partitions giving three 3 x 5-in. cells are soldered in place. Dividers of the top section extend 2 in. outside the open side, and are

(*Continued on page* 118)



FLORIDA POWER & LIGHT COMPANY'S Cutler Steam Electric Station in Miami . . . one of its many power plants serving dependable and low-cost electricity to the people and industries of the State. Designed and constructed by EBASCO, this plant was acclaimed by LeCorbusier, famous French architect, as "an outstanding example of esthetic expression in engineering."

Great Climate for Business, Too!

Industrial growth in Florida finds Ebasco on the job

Long one of America's most popular vacationlands, Florida has been making swift progress along industrial lines in recent years. Nobody knows that better than EBASCO, for this firm of engineers, constructors, and business consultants serves large and small companies in the Peninsula State—just as it does throughout the United States and the World.

Pictured here are a few typical EBASCO projects completed in Florida which illustrate the many different types of jobs EBASCO can handle from start to finish. They also illustrate the wide diversity of business firms which call upon EBASCO for an equally broad range of services. Because EBASCO integrates many specialized services and many skilled men into a single smooth-working organization, it is equipped to do an entire job, or any part of it.

If you need a new plant . . . or want to improve your present facilities . . . or have a special business problem of any kind, it will pay you to learn more about EBASCO's services. We have a booklet describing our services called "The Inside Story of Outside Help." If you would like a copy, write to: Ebasco Services Incorporated, Department M, Two Rector Street, New York 6, N. Y.

MODERN MERMAID strikes traditional Florida pose near smokestack of the Cutler plant. The Cutler plant was designed (as are all of Florida Power & Light's new plants) to preserve the scenic beauty of Florida.

CATTLE are big business in Florida. EBASCO designs and constructs transmission lines for Florida P & L which furnishes electricity to cattlemen and farmers.

ROADSIDE FRUIT JUICE STANDS and miles of citrus groves are constant reminders of Florida's citrus industry. EBASCO made an economic study of this industry for a prominent investment firm.

FROZEN ORANGE JUICE CONCENTRATES is another rapidly expanding industry in Florida. Minute Maid Corporation, a leader in the field, engaged EBASCO for engineering, space utilization and insurance services. The Minute Maid plant shown above is typical of many industrial plants which operate on electric power supplied by Florida Power & Light Company.

ENGINEERS · CONSTRUCTORS
EBASCO
BUSINESS CONSULTANTS

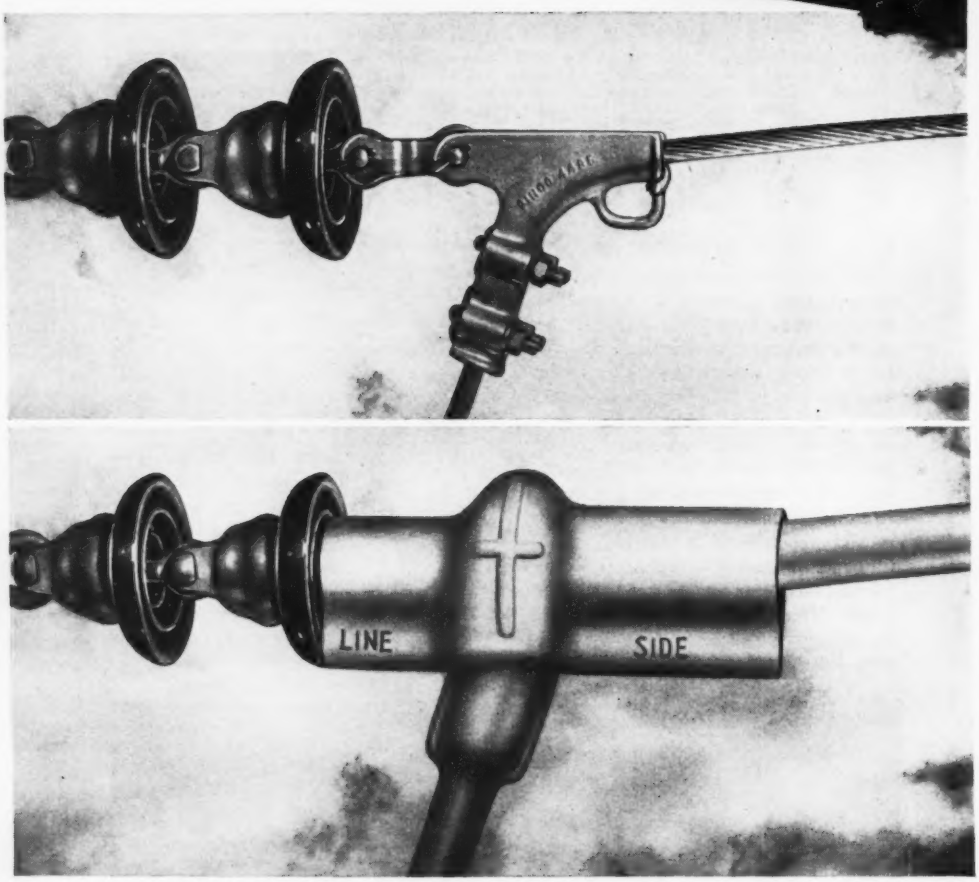
NEW YORK • CHICAGO • WASHINGTON, D. C.

Appraisal • Budget • Business Studies • Consulting Engineering • Design & Construction • Financial • Industrial Relations • Inspection & Expediting • Insurance, Pensions and Safety • Purchasing • Rates & Pricing • Research Sales & Public Relations • Space Planning • Systems & Methods • Taxes • Traffic • Washington Office

a lineman ASKS—

"How do we blanket 4468 and 4550 Pinco dead-end working lines 'HOT'?"

HERE'S



The Porcelain Insulator Corporation LIMA, N.Y.

Suspension Insulators . . . Clamps and Fittings . . . Switch and Bus Insulators . . . Distribution and High Voltage Pin Types . . . Guy and Tree Insulators . . . Special Porcelain.

NO. 14 IN A SERIES

the 4485, clamps when

OUR ANSWER:

These two photographs show the blanketing method employed by a well known utility on lines where these Pinco Dead-End Clamps are installed. It's a quick, efficient, safe method using *standard insulator hood and line hose.*

HERE'S WHY— **LINEMEN LIKE TO WORK WITH PINCO STRAIN CLAMPS...**

- Easy to blanket when working lines "hot."
- Have excellent snubbing action, making them easy on the conductor.
- Gentle "wave form" seat provides maximum conductor grip.
- "Come-Along" attachment is provided for easy installation of the conductor.
- Quadrant Type design of 4485, 4468 and 4550 allows continuous "running" of the conductor—eliminates necessity of cutting conductor at dead-end points to make "jumper" loops.

That's why linemen like Pinco Strain Clamps . . . and here's why utilities are specifying them for quick, easy, positive clamping of conductor in distribution line construction:

1. Time-saving features permit quick, easy, positive clamping . . . cut installation costs!
2. Rugged design and construction assures long-life; trouble-free performance. Constructed of highest quality malleable iron properly treated then hot-dip galvanized. Equipped with Steel U-Bolts and Cotter Bolts, hot-dip galvanized, also Spring Brass Cotter Keys.
3. All Pinco Strain Clamps are available for prompt shipment.

PINCO L 4550
Cable seat range .2" to .55" will accommodate All-Aluminum and ACSR conductors No. 4 through No. 1/0 and all other conductors in its cable seat range.

PINCO L 4468
Cable seat range .2" to .68". Designed for use with 2/0 through 4/0 ACSR or All-Aluminum Conductors and others in its cable seat range.

PINCO L 4485
Cable seat range .3" to .85". Recommended for use on 226,800 C.M., 300,000 C.M. and 336,400 C.M., ACSR or All-Aluminum and all other conductors in its cable seat range.

The above clamps can be supplied with aluminum or copper liners

PINCO INSULATORS

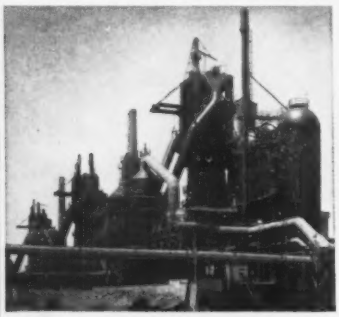
RIGHT ON THE JOB—

For complete information regarding Pinco Strain or Dead-End Clamps refer to Pinco Catalog No. 49 or contact the Joslyn office in your locality.

what's NEW in Engineering

An automatic welding machine, developed by a Michigan company, is claimed to duplicate the work of dozens of human welders. The octopus-like machine generates temperatures of 2000° F.; is water cooled. One operator can make 62 simultaneous welds with it. In one minute it can perform 744 weld operations.

Reducing coke consumption while increasing pig iron production was the dual problem facing Kaiser Engineers in designing and building blast furnaces for a California steel plant. A courageous new furnace



design gave record results—1335 tons of pig iron per day on furnaces rated for 1200 tons. These furnaces use 1409 lbs. of coke per net ton of iron against a national average of 1600-1700 lbs. per ton. We'll send you a reprint of an article by Dr. W. C. Rueckel which tells how Kaiser Engineers attained this outstanding furnace practice — with savings in capital and operating costs through increased production.

Simplified Drafting Practice, by Healy and Rau, is a best-selling new book which outlines a modern approach to industrial drafting. The method claims to cut drafting time 30-50%; reduce large blueprints to handy pocket size.

For those clients who want general consulting engineering services, such as economic studies, evaluation, investigation of manufacturing facilities, or analysis of operating costs, the full engineering experience of Kaiser Engineers is available. Call or write: Kaiser Engineers Division of Henry J. Kaiser Company, Kaiser Building, Oakland 12, California.

Paintbrush Container

(*Continued from page* 114)

bent in the form of a flat Z to slide snugly over bottom dividers. Hence with felt strips in the cupped flanges under compression from trunk locks, on ends of container, splash-proof, leakproof construction is assured.

Line Jeep Power Winch Handles 80-ft Poles

VIVIAN BUSHONG, Carolina Power & Light Co, Asheville, N. C.

Installation of power winches on all line jeeps used by Asheville Division of Carolina Power & Light Co has proved to be of great value in mountainous terrain. Poles up to 80 ft long can be easily handled, and

POWER WINCH installed on front of jeep chassis operates freely regardless of how chassis may be twisted. Note windshield-mounted radio equipment for easy servicing

large transformers and other heavy objects readily moved. Winches operate freely regardless of twisting of jeep chassis.

Additional weight of winch on front keeps jeep from turning over backwards while climbing mountains or steep grades. Front mounting also provides more body space for transporting material and men to the job.

Winch has more capacity than originally rated due to stepped-down in-gear ratio. All transmission gears can be used from low, to high and reverse. This aids the pulling of slack out of wire at high speeds, then changing to low for sagging wire. Low gear can also be used for moving heavy objects such as large transformers.

Five inches was added to the front of chassis to make room for winch installation which does not interfere with necessary maintenance and repairs of vehicle. J. R. Brown, Garage Supervisor in Asheville, designed and built necessary parts for winch installation. All materials used were found in various discard piles.

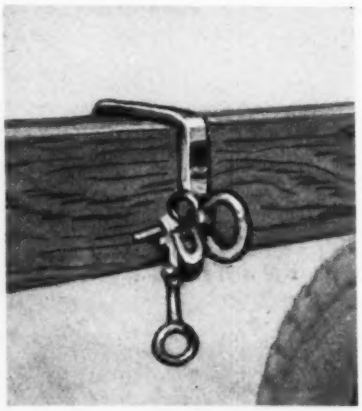
SETTING a 50-ft pole with jeep-mounted winch. Stepped-down transmission gears provide ample power for moving large objects

Tool Aids Hanging Oil Reclosers

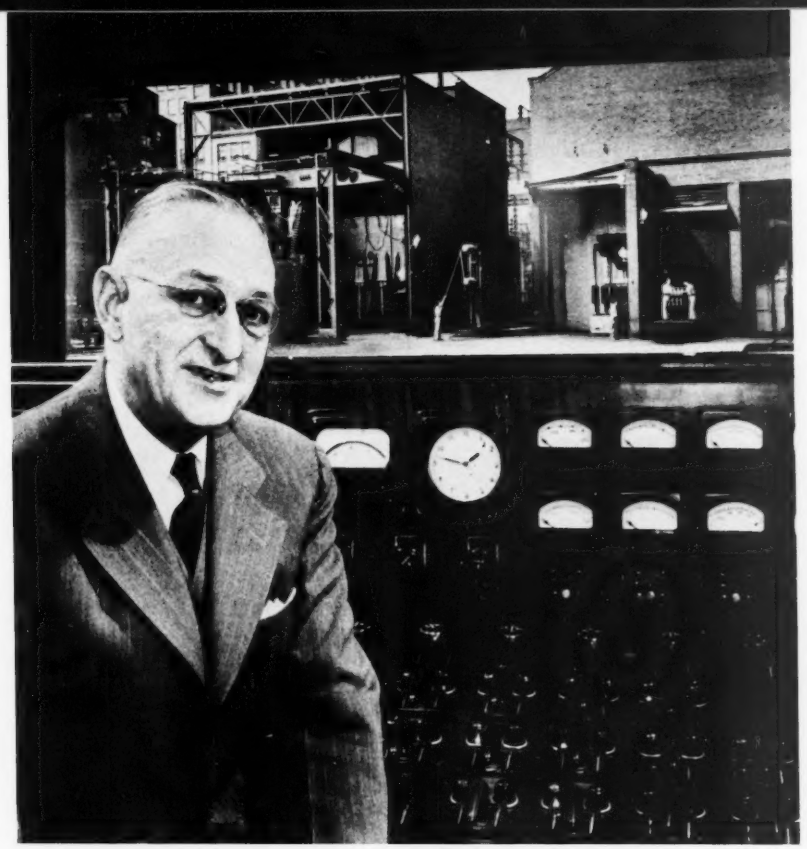
E. L. NELSON, Manager, Price Electric Cooperative, Phillips, Wis.

A simple light-weight tool, designed and made by Robert Anderson, lineman, Price Electric Cooperative, makes installation of oil reclosers on energized lines easier. It is fabricated from 1-in. wide strap iron, formed to fit over a crossarm, and with a loop and shank welded to it.

To use the tool a hot-line clamp is clamped to the tool shank and a hand-line block is hooked into the tool loop. Using a hot-line stick, which grips the clamp shank, a lineman raises tool and handline between energized lines and hangs the tool over a crossarm without danger of contacting lines. A recloser can then be raised and placed.



TOOL is placed over crossarm with hot stick and recloser is raised in usual manner



Meet . . . Mr. S. B. Griscom, Westinghouse Advisory Electric Utility Engineer, who will introduce, on the following pages, other experts on the Westinghouse Utility team to present pertinent facts on . . .

Handling increased loads on your distribution system

A. W. PAYNE
Unit Substations

W. T. PYLE
Standardized Substations

A. C. MEIXNER
Voltage Regulators

W. W. SATTERLEE
Distribution Transformers

F. E. REIBER
Cutouts

E. F. W. BECK
Arresters

R. E. MARBURY
Capacitors

L. C. BLEVINS
Meters

"Long-term planning is a vital factor in assuring ease of handling increased loads. Let's talk to Wally Payne."*

*Manager, Unit Equipment Sales

YOU CAN BE **SURE**...IF IT'S

Westinghouse Unit Substations make planning for load growth more practical

Installed to meet today's needs, they're readily adapted to handle tomorrow's loads.

This story shows how long-range thinkers in two Utilities used Westinghouse Unit Substations to solve one of their most pressing problems—load growth. Essentially, they needed equipment that would meet today's needs *economically* and still provide for future expansion. In each case, the great flexibility of Westinghouse Unit Subs helped provide the answer. See how they did it.

Unit substations aid southern Utility in long-range system planning.

A leading southern company serves a city's downtown section with secondary networks. A nearby fringe area was growing rapidly, but didn't warrant an underground secondary network—yet. So they installed Unit Substations in an overhead primary network to provide reliable and flexible capacity for a growing load. As the secondary network is expanded, capacity of the primary network is released to pick up load growth in other areas. The primary network Unit Substations can easily be modified to serve adjacent areas. They *don't* have to be rebuilt.

Eastern Utility finds Westinghouse Substations cheaper, easier to install.

A big eastern Utility was growing fast. Westinghouse Unit Substations were selected to serve a network in a heavily loaded urban area. Outlying sections are served by single-feeder Unit Substations—the Westinghouse CSP® Power Transformer. The 2000-kva unit matched their feeder capacity. Now as an area grows, another CSP Power Transformer is installed . . . easily and efficiently.

This company's cost studies have shown that Westinghouse Unit Substations cost less to install. They take less space, are easier to relocate if loads shift, and cut down on zoning problems.

It's important to remember that Westinghouse can supply substations of any type and size to serve all kinds of distribution systems. Yet all are made from standard components. The purchaser gets the benefit of repetitive manufacturing techniques.

Be sure to call Westinghouse when you're expanding your system.

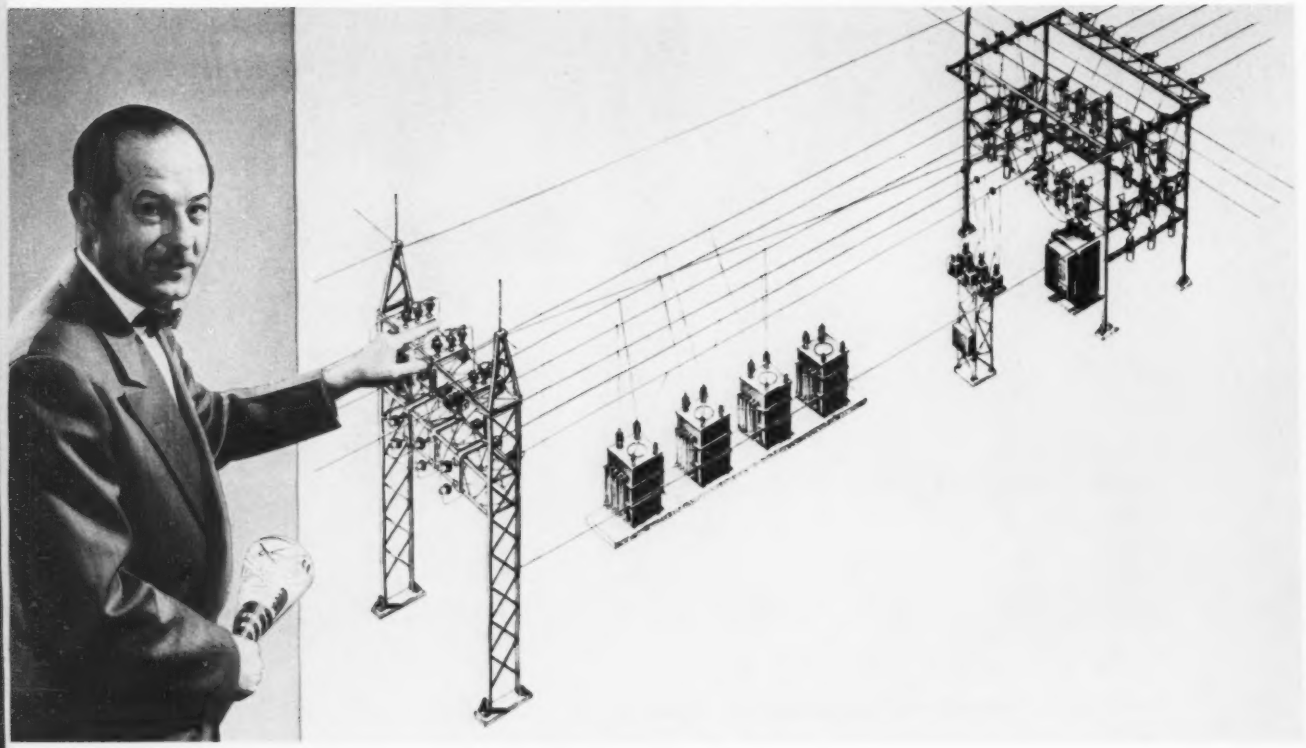
Westinghouse has a veritable storehouse of experience in building and applying unit substations. If you would like more information write now for B-4061. And, by all means, be sure to call in your Westinghouse Representative when you're contemplating a system expansion. J-60814

Automatic control for Westinghouse Under-load Tap Changers is housed in weather-proof cabinet mounted at a convenient height on the side of transformer.

Switchgear compartmentation provides safe operating arrangement and accessibility for inspection and maintenance. Unit construction permits feeders to be added readily to existing stations.

Westinghouse

"Let's consider the 'rural side' of this substation story. Wilbur Pyle, Sales Manager, Switchgear Devices, emphasizes this point . . ."



Westinghouse Standardized Substations: one low-cost way to meet load growth in rural areas

Thanks to a major Westinghouse development seven years ago, long-range planners in rural areas can now utilize highly economical equipment that brings much the same degree of flexibility and versatility provided in the Unit Substation. The Westinghouse Standardized Substation greatly simplifies system expansion and permits you to plan systems now that can readily be accommodated to future load growth.

You can start now with a simple, Standardized Substation with single incoming line and three outgoing feeders. Then, as loads grow, you can easily switch to larger transformers. The strain bus construction leaves plenty of space for new equipment. If you establish a loop system, you can readily convert the incoming single-line structure to a multiple-line arrangement by building onto the existing structure. Similarly, you can easily add additional feeders if they should be needed. All this simply isn't possible or practical with conventional substation designs.

This flexibility of Westinghouse Standardized Substations is a powerful factor when it comes to meeting growing loads. Another major advantage is their economy of installation in the first place. You save up to 10% in first cost. You don't have a lot of troublesome engineering and purchasing problems. When loads expand, you can get new substations in place far more quickly and inexpensively if you choose Westinghouse Standardized Equipment.

Get in touch with your Westinghouse Office for more information on Westinghouse Standardized Substations. And write now for booklet B-4697. J-60815

YOU CAN BE **SURE**...IF IT'S

Westinghouse

"Conducting an 'on-the-spot' discussion is 'Mike' Meixner, Manager Regulator Sales. He's describing how to—"

Handle increased loads . . . with faster regulation

We all know there are many complex problems associated with meeting increased loads. More intense—more frequent voltage variation on long feeders is one problem that can be greatly simplified with the new Westinghouse URL-16 Step Regulator! Here are some good reasons why—

Voltage can be corrected *faster* with only sixteen 1¼% steps covering the entire 20% range—a fact proved in actual field tests!

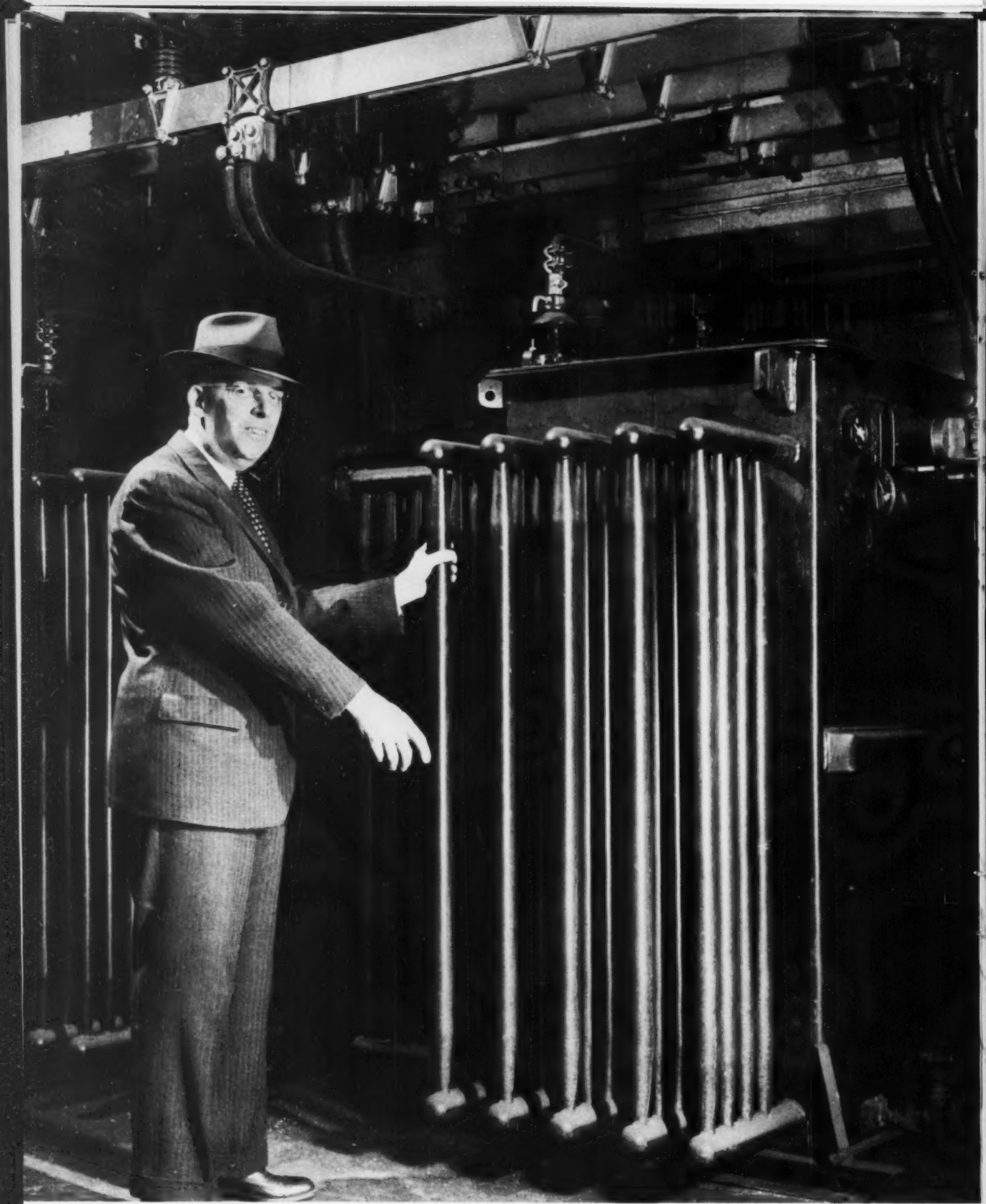
The CJ-1 Voltage Regulating Relay gives fast, sensitive reaction to voltage variations. It will positively hold a ±1 volt band!

An important feature relating to low cost —is the direct-drive tap changer; its simple design eliminates springs, latches, shock-absorbing elements. Fewer moving parts, fewer operations mean accurate regulation —at reduced operation expense.

Don't forget—when you're faced with the problem of meeting increased loads—investigate the Westinghouse pole-mounted URL-16 Step Regulator. You'll be impressed with the accurate, fast regulation, simple installation and low operating costs.

Get full information on the URL-16, from booklet B-5841. Write for it today! J-10396

Westinghouse



YOU CAN BE **SURE**...IF IT'S

"Bill Satterlee of the Transformer Division says this about the economic aspects of increased loads:"*

Change-outs to higher rated distribution transformers are now easier than ever

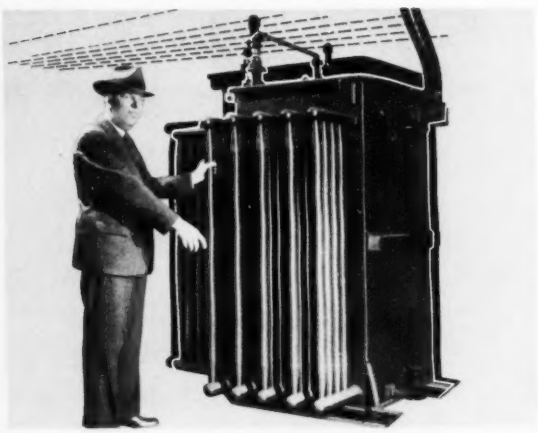
With growing loads, you can count on an increasing number of change-outs to higher rated distribution transformers. And the larger and heavier they are, the more costly the charge. That's why Westinghouse Engineers have worked constantly to reduce size and weight. The latest step forward is the Lowgrocap design.

Over the past 18 years, Type "SL" (150 to 500 kva) Transformer size has been reduced 12%; weight cut 30%. From this, your saving in change-out expense is obviously substantial.

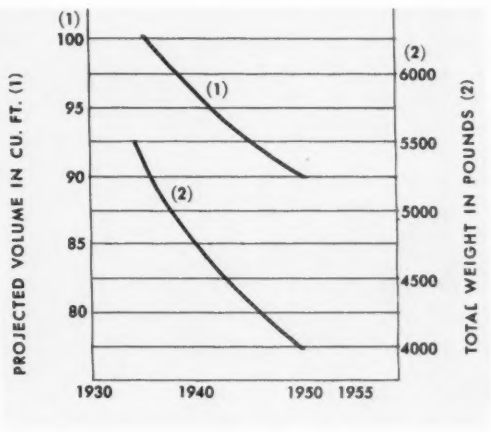
The latest design, Lowgrocap . . . short for "low ground capacitance" . . . offers more than size and weight reduction. A simplified transformer design, it achieves, in a cylindrically wound coil, nearly straight-line distribution of surge voltages across the windings. Low ground capacitance (conversely, high layer to layer capacitance) eliminates oscillation of the surge within the winding, removing the need for complex insulation structures.

In addition, Lowgrocap design offers these advantages: Top and bottom frames of the core-coil assembly are oil-impregnated maple. Leads can be firmly secured without special stand-off insulators. With this arrangement, the tap changer is located above the assembly where it is easy to inspect and maintain through the handhole. The tank is completely sealed with a welded cover, so that breathing and subsequent oil contamination is eliminated.

Advantages like these not only make it easier to keep pace with your load problem, but they also do away with many common maintenance headaches. Westinghouse Transformers of Lowgrocap design are available 250 to 500 kva, 2400 to 34,400 volts, single phase; 150 to 500 kva, through 34,400 volts, three phase. Ask your Westinghouse Representative for full information, or write for Descriptive Bulletin 46-100-SL. J-70683



The old and the new. Black area behind the transformer outline indicates space required by a transformer of this rating just a few years back. Note hv bushings extend into lv bus. Old design required larger, more costly vault.



Size and weight reduction. Upper curve shows how Westinghouse has cut size of the average "SL" Transformer from 102 to 90 cu. ft. of volume. Lower curve shows corresponding weight reduction from 5550 to 3900 pounds.

*Division Engineer

Westinghouse

"Even small protective equipment can effect large economies. Fred Reiber, Manager, Distribution Apparatus Sales, is proud of this . . ."

Now you can handle increased loads without changing cutouts!

Westinghouse recently pioneered this major development—the cutout that lets you increase circuit capacity without changing housings. All you do is install a higher-rated door; and the lineman does this with a hook stick. Simplicity itself. Now when loads grow you can be spared the costly trouble of changing the entire cutout.

This important development has been applied to a wide range of cutout types and ratings. For example:

For 5-kv service you can use these three doors in the same housings: The EA 50-amp door with 1200-amp interrupting capacity. The HC 50-amp door with 8000-amp interrupting capacity at 2.5 kv or 5000 amps at 5 kv. The MC 100-amp door with 8000 and 5000-ampere interrupting capacity. All are drop-out or non-drop-out as desired. Or you can use a disconnecting blade which doubles current-carrying capacity and, in effect, converts the cutout to a low-cost disconnect. This makes a total of seven doors which fit this housing.

You know the higher-rated door will fit properly in a Westinghouse Cutout because the housing is Prestite® porcelain. This is made by a process that produces high dimensional accuracy with excellent dielectric and thermal shock characteristics.

Get more information on these new cutouts that are so practical when loads increase. Write now for Descriptive Bulletin 38-610.

J-60816

YOU CAN BE **SURE**...IF IT'S

Westinghouse

"A new Westinghouse lightning arrester development has an important bearing on system growth. Here to tell about it is Ed Beck, Manager Lightning Arrester Design Engineering."

In the new LX Arrester

100% higher short-circuit capacity...to meet system growth

The new Westinghouse LX Arrester has the highest short-circuit capacity available today in an expulsion-type arrester—20,000 amperes at 3 kv. This is 100% higher rating than any other expulsion arrester. This means that you can apply LX Arresters today, with assurance that they will be able to handle tomorrow's higher power-follow currents resulting from system growth.

You can also make wider use of expulsion-type arresters, now that their range is extended. At 6 kv, the LX short-circuit capacity is 16,000 amps and at 9 kv, 12,000 amps.

Even though the LX has this high interrupting capacity, it has *low* sparkover. This is due to its unique design. The original spark gap is a straight line. However, as soon as the arc forms, it is forced into a spiral path, increasing its length. This reduces the actual current flow to a small fraction of the available fault current. It is current-limiting. Not only does this make for high short-circuit capacity, it greatly increases arrester life.

Westinghouse also makes a complete line of superior valve-type arresters which have no short-circuit limitations at all. These LV Arresters have high surge and thermal capacity which enables them to handle both "hot" and "cold" lightning.

Get more information on Westinghouse Arresters. Write for Descriptive Bulletins 38-140 and 38-150.

J-60817

Westinghouse

"Ralph Marbury, Manager Capacitor Design Engineering, has another important consideration we're sure you will want to keep in mind."

Westinghouse Capacitors . . . the low-cost way to increase system capacity

Nearly everybody uses capacitors in one way or another, but we venture to estimate that few Utilities have had time to make full use of their possibilities.

Think about your own system as you read these stories because capacitors are by far the cheapest way to get more load-handling capacity.

A southwestern company had a heavy inductive load from air conditioning and attic fans in homes. They studied the problem and decided the best bet would be small capacitors installed on the poles with the distribution transformers. Thus the kilovars would be supplied right where they are most effective—close to the load. Westinghouse developed a 3-kvar unit which enabled them to add more home load without making any other system changes. We're making these capacitors in volume now, and if you have this kind of problem, they're something to think about.

Some of the biggest improvements now are being made with the Westinghouse Autotrol®, our automatically switched capacitor. A midwestern Utility had long lines serving spread-out areas. Loads were growing, and new distribution transformers and new feeders were contemplated. A careful check showed, however, that in eight of the 14 areas under study, heavy reactive loads were cutting down on line capacity. This Utility installed Autotrols in these areas and solved the problem—at only $5.66 per kvar—far cheaper than new lines and transformers.

The complete line of Westinghouse Capacitor Equipment includes controls for every type of application—voltage, current, kvar or time. Write now for more information. Ask for Descriptive Bulletins 49-110-3 and 49-310. J-60818

YOU CAN BE **SURE**...IF IT'S

"Now Dick Blevins, Manager Meter Application Engineering will discuss some new metering developments and show you . . ."

How to meter your increasing loads economically

Westinghouse specializes in developing metering equipment that conveniently and economically handles increased loads. Here are some examples . . .

Now you can use a *factory-built* metering package with standard transformer-type meters in the 200-400-amp range. The Westinghouse Transocket® and its companion, the Trans-A-Mount® (for bottom connected meters) contain current transformers, heavy current terminals, and a pre-wired socket—all in one handy box. The cost is only about half of the separate components and you're spared the assembly job. The factory-built package occupies only half as much space and there is no sacrifice in accuracy.

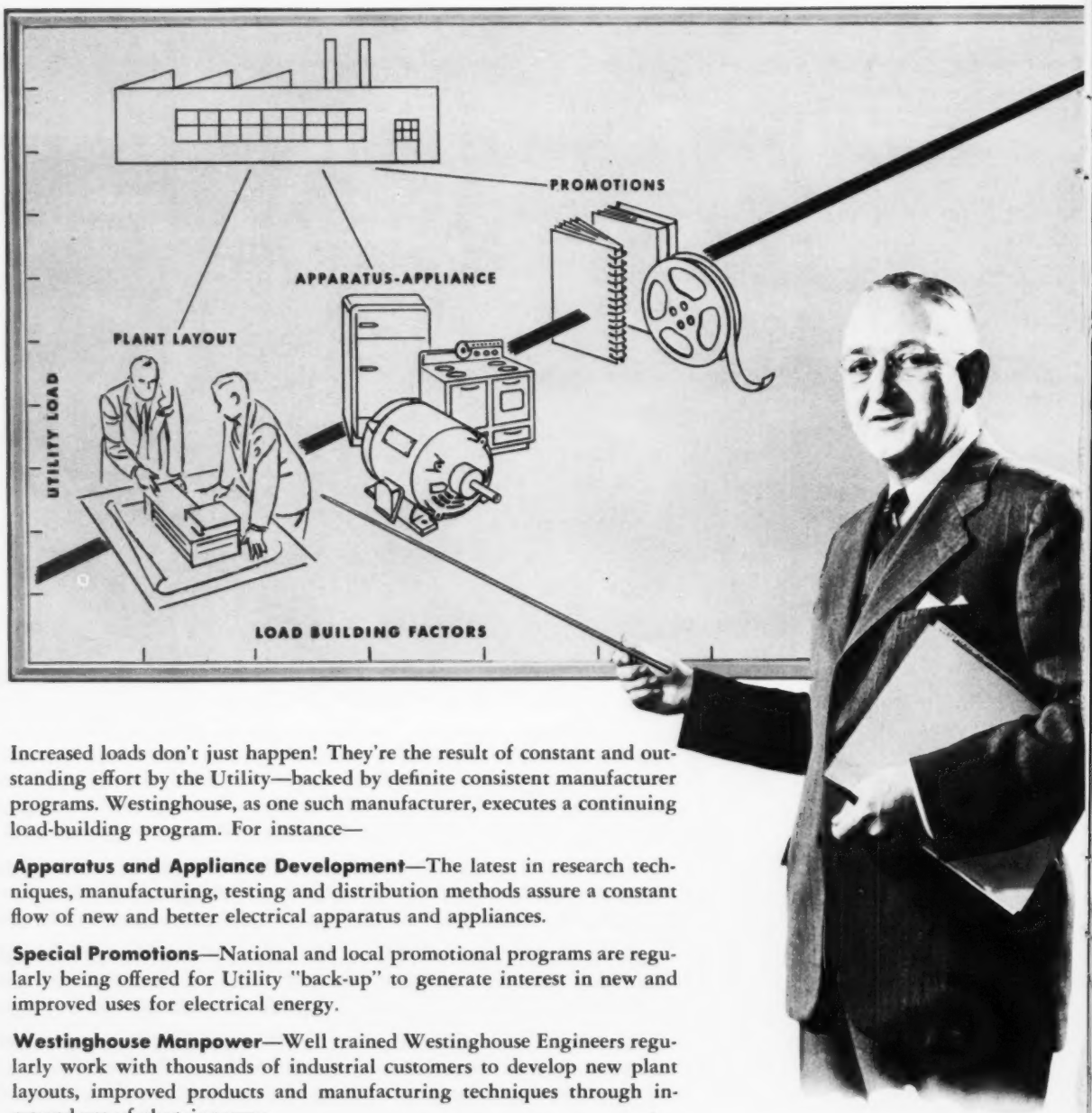
In the under-200-amp range, a similar advantage is also available. When the load rises above the normal 100-125 amps, you can install a Westinghouse STU High-Capacity Socket for 50-amp, self-contained meters. You needn't use current transformers. The STU extends the range to 200 amp, single-phase and 175 amp, polyphase.

If your loads grow to the point where demand metering is desirable, Westinghouse can help you again. You can convert all standard Westinghouse Watthour Meters to meter kw demand simply by installing an indicating or cumulative demand register. We make a complete line of both mechanical and thermal demand meters. An outstanding new development is the KCA polyphase combination watthour and thermal kva demand meter. Now, for the first time, it makes economic metering of kva demand on all loads practical.

When you think of metering growing loads, contact Westinghouse. And write now for this new information: DB 42-800 covering sockets and DB 42-300 on types RW and RW-2 kw demand registers. J-40442

Westinghouse

"Here's How Westinghouse helps Utilities build load . . ."



Increased loads don't just happen! They're the result of constant and outstanding effort by the Utility—backed by definite consistent manufacturer programs. Westinghouse, as one such manufacturer, executes a continuing load-building program. For instance—

Apparatus and Appliance Development—The latest in research techniques, manufacturing, testing and distribution methods assure a constant flow of new and better electrical apparatus and appliances.

Special Promotions—National and local promotional programs are regularly being offered for Utility "back-up" to generate interest in new and improved uses for electrical energy.

Westinghouse Manpower—Well trained Westinghouse Engineers regularly work with thousands of industrial customers to develop new plant layouts, improved products and manufacturing techniques through increased use of electric power.

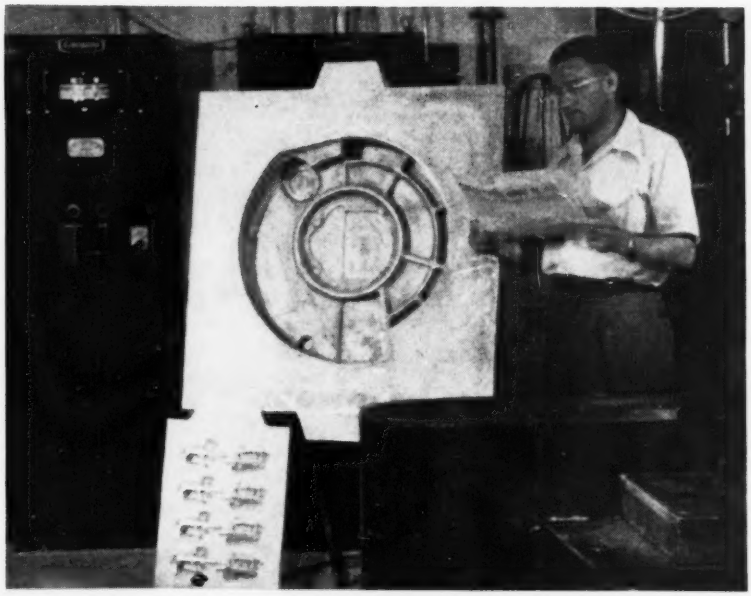
All these things are designed to help build more load. You can be sure of their continuance—and long-term success.

For more details on this subject or those presented on preceding pages, get in touch with your local Westinghouse Representative—or write direct to Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.

CP-1002

YOU CAN BE **SURE**... IF IT'S

Westinghouse



MELTING FURNACE (in foreground) makes consistent aluminum precision casting possible. Contamination of the melt, experienced with former oil-fired furnace, has been eliminated. Note control panels in background

Electric Melting Makes Precision Castings

GRAHAEME C. JAMISON, Industrial Consultant, Area Development Dept, Western Massachusetts Electric Co, Springfield, Mass.

Precision casting of perfect aluminum patterns is made possible by a 35-kw electric melting furnace at the Springfield Pattern Works, Inc, Springfield, Mass. The electric furnace, which replaced an oil-fired furnace, is operated on one phase of the 240-v, 3 phase service.

According to G. C. F. Carlson, owner of the company, segregation of ingredients in the melt is prevented by the gentle agitation of the molten aluminum in the furnace and troublesome contamination of the melt has been entirely eliminated by the switch from oil to electricity.

Swiftly responsive automatic temperature controls hold the aluminum at just the right temperature for pressure casting at 5 psi, without local overheating which is characteristic of flame-melting. Other benefits of the electric melting furnace are the absence of combustion and flues. Shop temperatures are lower with less noise and cleaner working conditions. Employees can now do their best work.

The furnace has two chambers, one in which aluminum ingots are charged cold and the other from which the molten aluminum is ladled ready for casting in plaster molds. Equipment comes complete with control and automatic temperature regulating panels. Furnace has been in operation for 20 months without relining.

Air Conditioning Cuts Dampness

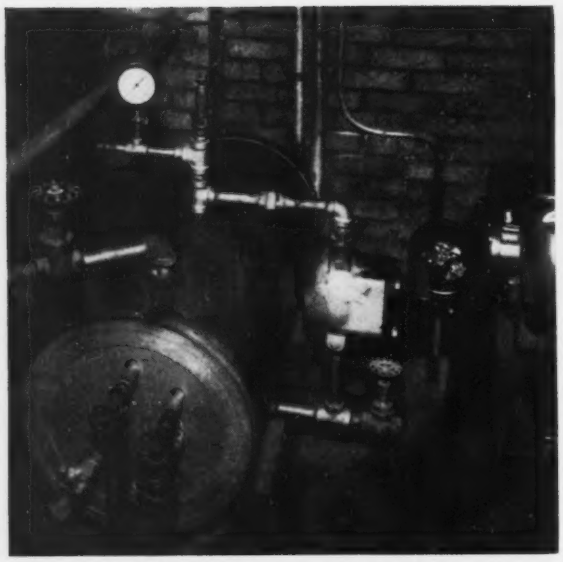
STORAGE ROOM air, kept at 76 F and 45% humidity by air conditioning system, pulls dampness out of suits in 6 hr and keeps them in press

L. ALBERTSON, Application Engineer, Philadelphia Electric Co.

A 150-ton air conditioning system at H. Daroff & Sons, Philadelphia, Pa., gives precise control of humidity in a 90,000 garment storage room to keep garments in finest condition for shipping.

Coats and suits pick up dampness in final pressing and if they are shipped damp would arrive wrinkled. But with temperature and humidity accurately controlled by air conditioning, 20,000 garments tailored each week go out in good shape and are crisp and salesroom fresh on arrival at the retailer's.

Air kept at 76 F and 45% humidity pulls practically all the dampness out of suits in 6 hr and keeps them in press, ready for shipment at any time. Dirt, dust, and grime are eliminated.



STEAM GENERATOR saves floor space and eliminates fumes, also coal or ash handling. Generator is used only for high pressure steam

Fire Hazard Reduced With Electric Steam Generator

R. I. LAVELLE, Industrial Power Engineer, Duquesne Light Co, Pittsburgh, Pa.

Generating high pressure steam with a 10-kw electric steam generator in the research laboratory at the Watson-Standard Co., Pittsburgh, Pa. reduces fire hazard, saves floor space and eliminates fumes and coal or ash handling equipment. Steam is available "at the flip of a switch" at any desired pressure up to 200 lb. The generator is used only when high pressure steam is required.

The high-pressure steam is used to heat both a retort and the rolls of the mill. Since the building itself is heated by a low-pressure steam heating system, another source is required for high pressure steam. With this new steam-heated dispersion mill it is now possible to have a continuous check on new products, from the processing of the basic material through application and final tests for serviceability.

Electronic Battery Charging Saves Floor Space

L. J. LANGEVIN, Power Engineer, Cincinnati Gas & Electric Co

The installation of 18—5-kw electronic mercury tube battery charging rectifiers at Globe Union, Inc, Cincinnati, Ohio, has released valuable floor space. This type equipment, which is hung from ceiling beams, will eventually replace the motor generator portion of their 400-kw capacity.

Equipment is located at the load, and eliminates the need for long and large bus duct runs. Each unit can be operated at full load at its most efficient point because of its small rating. If fewer batteries are being charged, rectifier units are cut out. This is in contrast to large M-G installations where they often operate at ¼ load or less at poor efficiency. The maintenance cost on these units has been very favorable and was probably the largest single factor in the selection of this equipment.

Each rectifier has an ac input rating of 440 v, 3 phase, 60 cycles and a dc output rating of 5000 w at 180 v. Each unit consists of two full wave rectifier sections. Each full wave rectifier section consists of two mercury vapor tubes with one tapped plate transformer and one non-tapped filament transformer. A tap selector switch is provided for the plate circuit for selection of desired plate voltage.

INDUSTRIAL BRIEFS

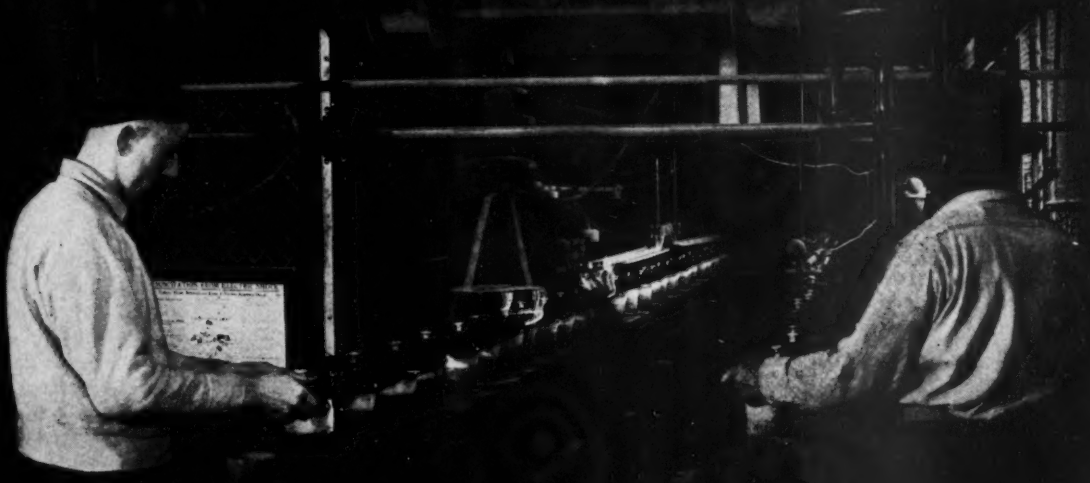
Cleaning printing press Patent Base Chases at Shaw-Barton, Inc, Coshocton, Ohio, by an improved method making use of electric immersion heaters, requires only a fraction of the time formerly required with cold solution. All handling is eliminated, except for placing plates in tank and removing after cleaning cycle. This method has also eliminated a safety hazard, and has immeasurably improved cleanliness of work area. A shallow metal tank containing a cleaning solution is equipped with perforated pipes near bottom. Compressed air agitates solution producing scrubbing action on plates. Due to space limitation, 4-1,500-w tubular heaters designed for use in coffee urns, are installed through the bottom of tank below air pipes. Doran A. Sauers, Jr., Industrial Power Eng., Ohio Power Co, Coshocton, Ohio.

Heating driers (humidity controlled) with oil-fired heat exchanger at Federal Refractories, Mineral City, Ohio has replaced hand-fired steam boilers with saving of $1000 per month. Heat exchanger has 15 hp electrical load and controls are fully automatic. Cost was about $10,000. G. W. Craiglow, Ind. Power Eng., Ohio Power Co, Canton.

Indicator lights on colored rest room to show when in use has saved approximately 35 man hours daily and increased production at Rathbone Hair & Ridgway Box Co, Savannah, Ga. The congregating of colored employees in that area with excuse of waiting for empty stall, has been eliminated. Lights work on reverse push button switch. When door is shut, indicator light turns "on." C. D. Anderson, Power Sales Engineer, Savannah Electric Power Co.

Heat treating metal baler parts with resistance type cabinets at New Holland Machine Division of Sperry Corp, Lancaster, Pa reduces fire hazard and handling costs. Labor costs are cut and a better product produced. The 150-kw installation replaces formerly used bottled gas equipment. Norman Hartman, Industrial Representative, Pennsylvania Power & Light Co, Lancaster.

VICTOR *PURIFIED PORCELAIN* SUSPENSIONS
RUN THE GAUNTLET TO GIVE YOU GREATER SERVICE



Victor No. 924 (25,000 lb.) Suspensions undergoing high frequency and 60-cycle flashover tests on Victor-designed continuous testing machine.

VICTOR NO. 924
(25,000 lb.)
SUSPENSION

Every Victor Suspension Insulator has to "run the gauntlet" through the flashover testing machine illustrated here. And every one must stand up under both high-frequency and 60-cycle flashover for a period of more than three minutes before being eligible for shipment. This stringent, individual testing, coupled with the greater toughness, uniformity and resistance to impact of Victor *Purified Porcelain* gives greatest possible protection for your lines! More reasons why Victor is the power man's best buy! For full data on Victor Suspensions, write for Bulletin No. 4.

FREE BOOKLET gives you the full story on how Victor insulators are made—how and why *Purified Porcelain* was developed. Write us for your copy.

Specify VICTOR INSULATORS!

VICTOR INSULATORS, INC., VICTOR, N. Y.

Low and High Voltage Pintypes • Suspensions • Guy Strains • Spools • Switch and Bus Insulators • Custom Designed Porcelain

Chattanooga's new Edney Building where . . .

Electricity Heats, Cools TVA Offices

HEATING and air conditioning units are housed in a utility room on each floor and feed into a common duct system

Extensive arrangements for electric heating and air conditioning are incorporated in Chattanooga's new Edney Building, seven floors of which house offices of the Tennessee Valley Authority.

Heating and air conditioning equipment is installed on each floor of the eight-story structure, the first large office building in the city to be heated electrically. Space required for the equipment is offset by savings in duct space.

Estimated cost of heating electrically is $200 per year more than the cost of gas heat, with installation expenses being about equal. Cost of cleaning burners and adjusting for proper burning efficiency, plus cost of including a stack or flue in the building, prompted selection of an all-electric installation.

Large Coverage . . . Each floor has 8,982 sq ft of floor area. Ceilings are 9 ft, except on the ground floor where ceilings are 11 ft over part of the area and 14½ ft over the remainder. First floor has a volume of 107,660 cu ft and the others, 80,838 cu ft, a total of 673,526 cu ft.

First six floors have 40 kw each of fin type strip heaters. The seventh floor has 65 kw of heaters and the top floor, 70 kw. Increase in capacity in top floors is due to extra exposure and added glass on the south side. Top floor ceiling is insulated.

Each floor has two zones equally divided so that heating load is balanced, half for each zone. Each bank of heaters is controlled in four stage steps so that only the required capacity comes on as the thermostat demand calls for heat. There is a 135-kw bank for preheat makeup air during extreme weather conditions.

There is a 5-hp blower on each floor for air circulation. Total heating load is 510 kw, or .76 w per cu ft, exclusive of fan load of 44 kw.

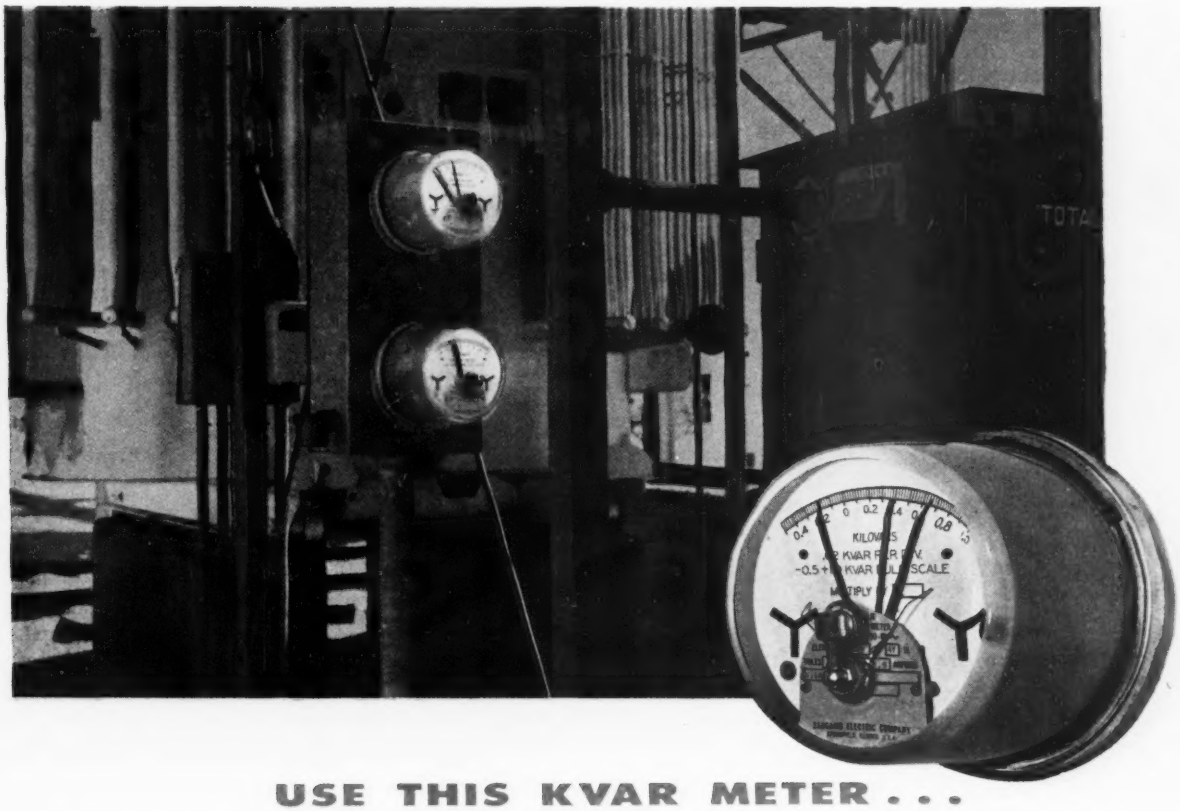
Air Conditioning Setup . . . First and seventh floors have four 5-hp air conditioning units each. The top floor has five 5-hp units, and the others have three 5-hp and one 3-hp units each. The 5-hp units are rated at 5.77 tons of refrigeration each and the 3-hp units at 3.5 tons each.

Units are controlled in step stages, so that demand is satisfied without excess capacity coming on the line. Any

Record of First Year's Operation

Period	Kw Demand	Kwhr	Cost
June 11 to 19, 1952	32	6,400	81.07
July 19	145	52,000	463.00
August 19	146	58,400	489.60
September 19	160	40,800	433.20
October 20	132	35,200	382.00
November 19	240	40,800	513.20
December 19	304	78,400	727.60
January 19, 1953	336	116,800	896.40
February 20	400	117,600	962.80
March 19	444	78,400	867.60
April 20	352	76,000	766.00
May 19	372	83,200	814.80
June 19	368	126,400	957.20
July 20	368	133,600	978.80

KNOW THE REACTIVE IN YOUR SYSTEM



USE THIS KVAR METER . . .

one of the Lincoln "Indicating Meters with a Memory"

Distribution engineers are increasing system capacity by the application of capacitors to correct for reactive power which may be limiting full use of present facilities. This practice also effects economies in operation. However, accurate knowledge of the load at all times is vital to proper capacitor application.

Permanent installations of Lincoln KVAR Indicating Meters give these necessary facts. They tell the existing reactive demand, whether lagging or leading, and remember the full variation of the KVAR demand which occurred since resetting. Lincoln Meters are rugged and accurate, and they require practically no maintenance.

Full information is given in Bulletins 440 and 410. They're yours for the asking.

* * *

Have you received your copy of "Solving Distribution System Problems through Measurement"? It provides the answer to your load growth problems. We'll be glad to send you a copy.

SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

Only Measured Facts are Known Facts

SM53-7

unit can be removed for replacement with a new one without a stoppage of the entire bank.

Since heating and air conditioning of each floor is operated separately, there is a high degree of flexibility of operation. For example, if special work must be done by occupants of one floor at night or on a weekend, only that floor, or section of it which is occupied, need be heated or air conditioned. This overcomes the need for services of a maintenance man or operator.

During the first 14 months of operation, slightly over a million kwhr of energy has been used for heating and air conditioning, at a cost of about $9,300. Of this, heating cost was $4,775, or .71 cents per cu ft.

APPLIANCE	USERS	STILL POTENTIAL
Home freezers	14,100	125,000
Refrigerators	122,900	25,000
Dishwashers	5,500	133,600
Garbage disposers	2,500	136,600
Kitchen exhaust fans	13,200	125,900
Laundry dryers	1,300	134,600
Washing machines	99,200	48,000
Ironers	9,200	129,900
Water heaters	99,000	55,000
Room air conditioners	9,200	128,400
Attic ventilation	12,100	52,300
Window ventilation	74,700	52,300
Television sets	98,500	40,600
Vacuum cleaners	45,200	93,900

With this survey of buyer potential as its spur . . .

NOPSI Aims for the Maximum Market

New Orleans Public Service, Inc. is hot on the heels of its dealers, prodding them to more aggressive selling.

It is doing this with a steady stream of promotional and advertising material stimulated with sales meetings and cash and other prizes for individual accomplishment.

"There is nothing like a prize to shoot at to get the fellows hustling," says E. N. Avegno, dealer sales manager.

Going along with his theory is the New Orleans Electrical Association, which cooperates with NOPSI in campaigns on each major appliance. In addition, a committee of distributors, dealers, and wholesalers get together to coordinate the program.

Bonus to salesmen is made up of funds supplied by the dealers and wholesalers or distributors, based on each unit sold during the course of a campaign.

Survey Completed . . . Backgrounding the program is a survey recently completed by NOPSI of the potential market for each appliance among its 139,100 electric customers. Thirteen meter reading routes, representing about 2% of the residential customers, were used as a sample. Interviews were made by customer service representatives of the company's residential division.

Accompanying table shows what they found as the market for electrical appliances.

Results were summarized in a booklet, "Business Opportunities." Information included several surprises. For example, 96% of the market is unsold on dishwashers; 98.2% on garbage disposer units; 90.5 on kitchen exhaust fans; 96.8% on dryers; 93.4% on ironers; 92.4% on air conditioning room units; and 67.5% on vacuum cleaners.

NOPSI feels that there is room for sales of most appliances and the replacement market is growing larger from year to year.

So it keeps dealers informed on campaigns ahead and what appliances will be featured each month.

Dealers, naturally, like the calendar for they find them good guides to organized planning.

What's Doing In Sales Activities

These briefs are intended to facilitate exchange of information among electric utilities on current, planned, and recent sales activities. For details on any activity, request should be made to the source of the particular brief. Your help in supplying material for this column will make it more meaningful.

Range Campaign—Pennsylvania Electric Co, Johnstown, Pa. "Buy your electric range now and operate it free for the rest of the year." With this special offer, 550 dealers set their sights on 1200 range sales in the month of May. They sold 1,483 during that time.

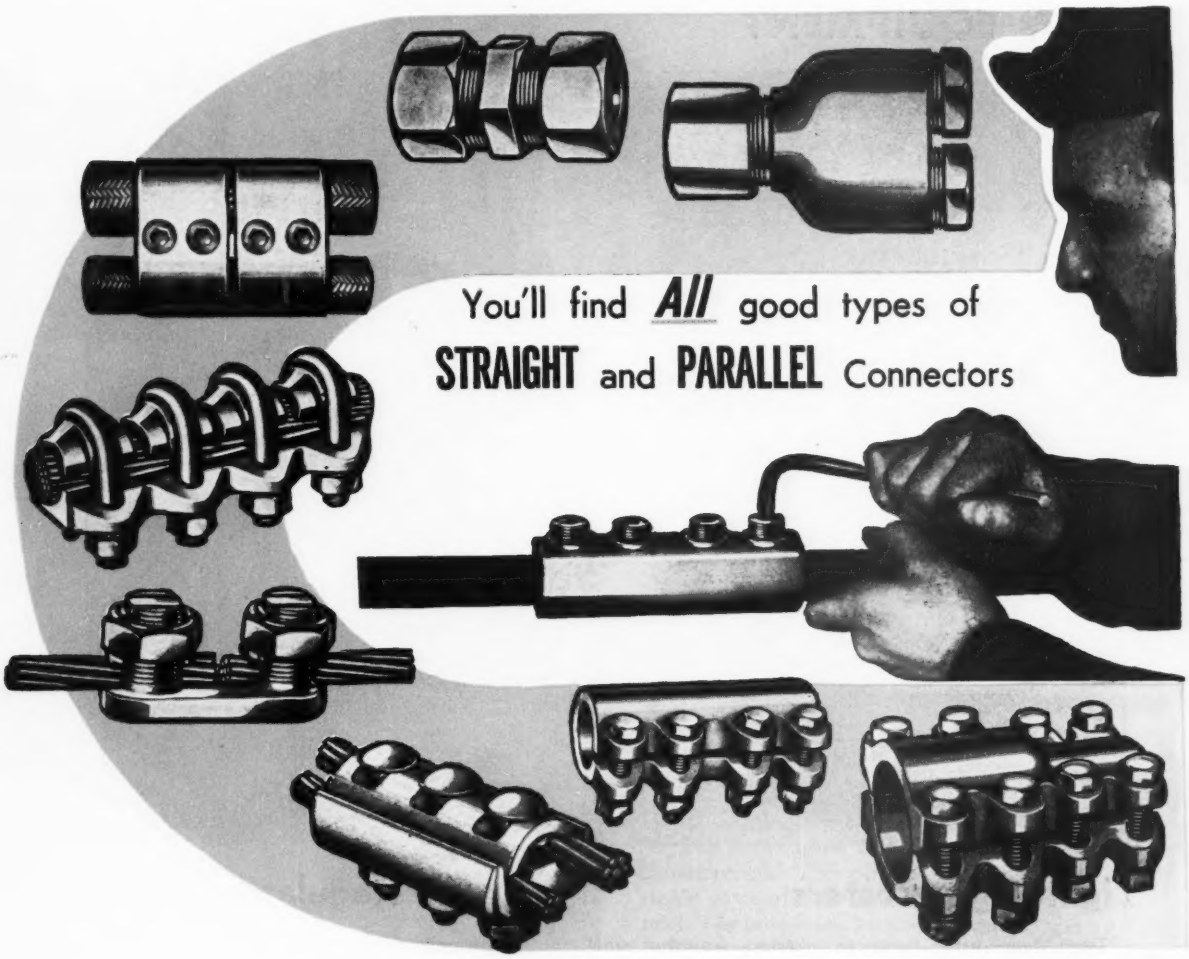
Dealer-Utility Sales Promotion Program—Jersey Central Power & Light Co, Asbury Park, N. J. F. I. Smith, sales manager. Dealers joining in the program are given decals designating them as "JCP&L Authorized Reddy Kilowatt Dealers," are eligible for cash promotional allowances, and receive other assistance from the company.

Sales Operations over the Year—Georgia Power Co, Atlanta, Ga. C. N. Wallace, sales manager. "What it's to be in '53" in merchandising, rural activities, home service, lighting, power sales, and advertising. Managers of sales department divisions outline their plans for the year.

Fan Promotion — Empire District Electric Co, Joplin, Mo. J. T. James, manager merchandise sales and service. On hot evenings radio spot announcements offer immediate delivery and setting of window fans for comfortable sleep.

Room Air Conditioners—Tampa Electric Co, Tampa, Fla. M. T. Anthony, sales manager. "This'll tickle ya," folder distributed to dealers to enlist them in company promotion of room air conditioners. Schedules of newspaper and radio advertising and offer of store and window posters.

Co-operative Advertising Plan—Otter Tail Power Co, Fergus Falls, Minn. S. Swensen, merchandise manager. Allowance of 50% of space cost for newspaper advertising of local dealers tying in with company ads.



in the *Complete* line

Yes, it's mighty handy to open your Penn-Union Catalog and pick the exact type you need. They're all there—in a complete range of sizes; Bolted straight connectors . . . screw type . . . various split sleeve types . . . shrink fit . . . universal clamps . . . E-Z connectors with yoke and nut, etc.

The Penn-Union Catalog also gives you the *complete* line of service Connectors, Tees, Cable Taps, Grounding Connectors, Lugs, Power Connectors, etc.

Preferred by leading users—who have found that *"Penn-Union" on a fitting is their best guarantee of unfailing service.*

Sold by Leading Wholesalers

PENN-UNION ELECTRIC CORPORATION, Erie, Pa.

Canada: Dominion Cutout Company, Ltd.
250 Richmond St., West, Toronto

THE *Complete* LINE OF CONDUCTOR FITTINGS

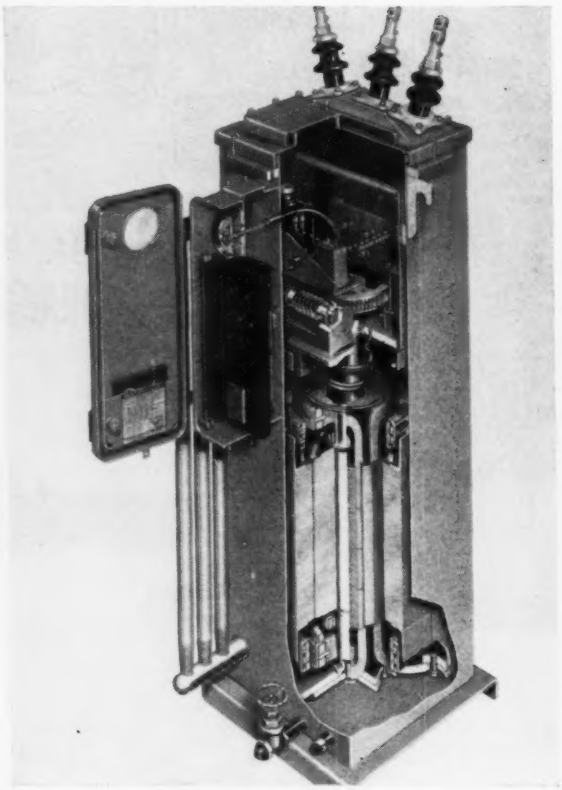
PENN-UNION

NEW EQUIPMENT

Lightning Arresters

Two Magne-valve lightning arresters featuring small size and light weight have been announced for 7,200- and 7,620-v unit-type distribution transformers. For 7,200-v transformers, the 9-kv arrester is 14¼ in. long and weighs 10 lb. The 10-kv arrester, for 7,620-v transformers, is 15½ in. long and weighs 11 lb.

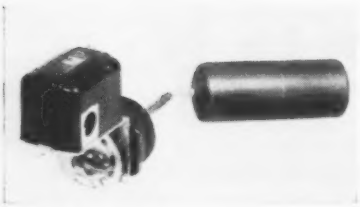
Both arresters are gapped to the bushing and have impulse characteristics similar to those of the company's pellet arresters. The new arresters also feature Thyrite valve action augmented by magnetic action of internal series gaps. This is said to permit application anywhere on the system without regard to 60-cps short-circuit currents.
General Electric Co, Schenectady 5, N. Y.



Voltage Regulator

Improvements in the Type SU induction voltage regulator have resulted in a lighter and smaller unit that is said to be simpler to maintain. Mechanical adjustments have been eliminated for the control, and the Type SJ voltage regulating relay is used. This relay has no pivot or guide bearings.

Relays are now mounted on the back of a swinging panel to facilitate inspection. A hand wheel at the upper end of the vertical motor shaft allows easy hand operation. A vertical terminal board has connections for either series or parallel operation of the secondary windings. Links make possible connection changes.
Westinghouse Electric Corp, Pittsburgh 30, Pa.



Float Switch

A new screw-in tank float switch for condensate pumps has been designed to provide automatic control of liquid level. Float position can be changed from right to left hand side. Contacts may be converted to either open or close on liquid rise.

Two-pole, double-break, silver-to-silver switches in the Class 9037 Type HG are available for 110-220 v and 440-550 v. Operating mechanism is of the positive snap action, toggle type. Enclosed parts are cadmium finished steel. Immersed working parts are brass, copper, or stainless steel.
Square D Co, Milwaukee 12, Wis.

Motor Generators

A line of low-voltage motor-generator sets, rated from 300 to 20,000 amp, has been announced. Generators of this redesigned line are said to feature the following improvements over the company's former units:

1. Increased accessiblity of brushes, coils, and commutator.

2. Higher overall efficiency because of unrestricted air circulation around and through the generator.

No Cutting . . .
No Twisting . . .
No Loosening . . .

HUBBARD
U-Strap Wide Base Clamp Pins

THE Hubbard U-Strap Wide Base Clamp Pin is designed for angle and corner construction. The pin is forged from a single piece of new hot-rolled open hearth steel. The broad base rests evenly on the arm and prevents the pin from cutting into the wood, while the four lugs hold the pin from twisting on the arm.

Many Utilities have standardized on the Hubbard Wide Base Clamp Pin for all construction, owing to the fact that these pins serve equally well on angles and straight line work. The pins are a "long-lived" design and the encircling strap protects the arm against checking. The design has been a favorite for more than thirty years.

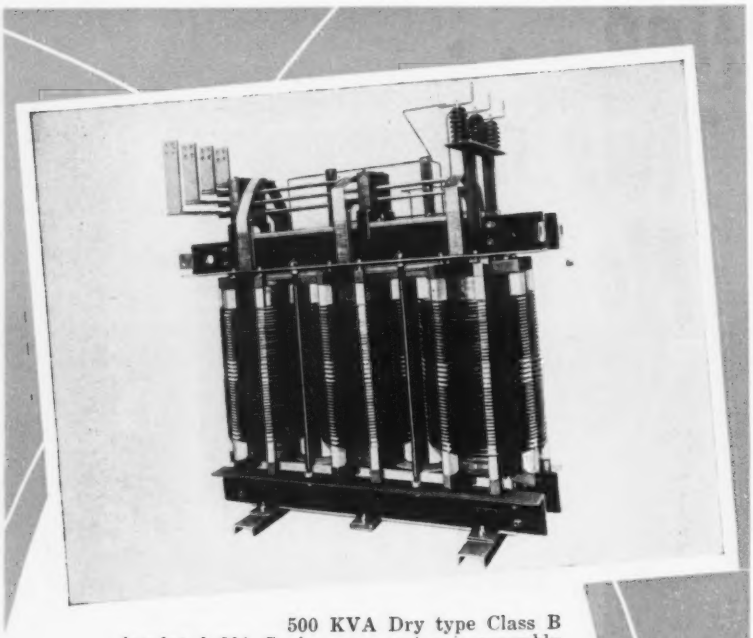
Stock numbers for pins and straps should be listed separately when ordering as straps are not included with pins.

HUBBARD AND COMPANY

ESTABLISHED 1843

PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA

"Hang the Load on Hubbard Hardware!"



500 KVA Dry type Class B insulated 80° C rise core and coil assembly 13800 V Delta to 208 Y/120

EVERY STOCKWELL TRANSFORMER is the result of specialized research and sound design. Rigidly controlled materials and modern production facilities are additional guarantees of the quality of our products.

Our field organization and our staff of application engineers at Akron will be glad to help you on all your transformer and substation problems.

STOCKWELL

TRANSFORMERS

DESIGNED FOR YOUR REQUIREMENTS

STOCKWELL TRANSFORMER CORP.

AKRON, OHIO

OIL-FILLED, DRY TYPE, and ASKAREL-FILLED DISTRIBUTION AND POWER TRANSFORMERS

3-1

3. Greater protection for exciter brushes by mounting them on the inboard side. This also aids smooth operation.

4. Increased brush life because of sparkless commutation, even at the guaranteed overload capacity of the generators.

5. Overloading without heating because of over-size split-sleeve bearings adjacent to the commutators, also assures smooth operation.

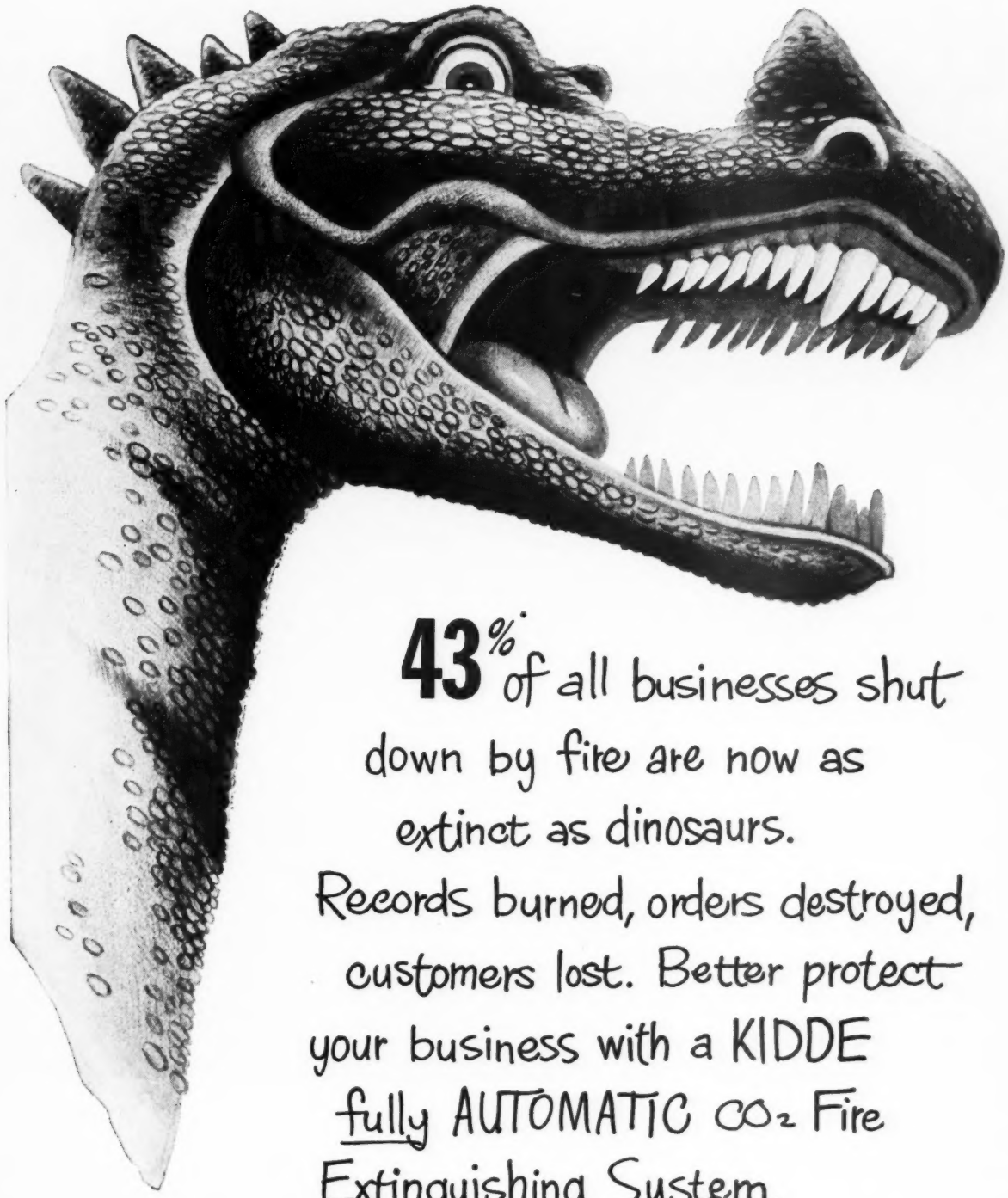
Prime movers are direct-connected, low-speed, heavy-duty, synchronous motors with either 80% leading of unity power factor. High pull-out torque and across the line starting are motor features.

Chandeysson Electric Co, St. Louis 16, Mo.

Flow Detector

A precision flow detecting instrument, called Detect-A-Flo, designed to sense and respond to changes or stoppages in the flow of air has been announced. It may also be used as a liquid-level detector or controller in storage and supply tanks. The instrument can be set to respond to any mass rate of air flow in the approximate range of 1,000 to 50,000 lb per hour per sq ft.

Detect-A-Flo operates with one leg continuously heated by a small heater. As the flow rate drops, the heated leg expands because less heat is conducted away. Resulting expansion is transmitted through lever action to a strut-and-electrical-contact assembly in the



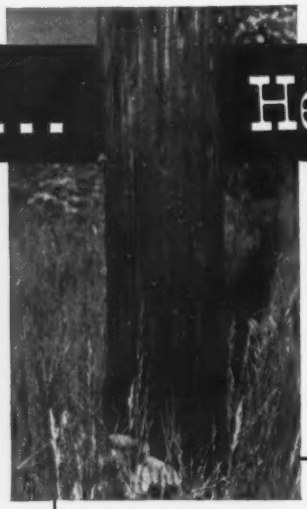
43% of all businesses shut down by fire are now as extinct as dinosaurs. Records burned, orders destroyed, customers lost. Better protect your business with a KIDDE fully AUTOMATIC CO_2 Fire Extinguishing System.

Kidde

Walter Kidde & Company, Inc.
930 Main Street, Belleville 9, N. J.
Walter Kidde & Company of Canada, Ltd., Montreal, P. Q.

*according to a survey by the Safe Manufacturers' National Association

The word "Kidde" and the Kidde seal are trade-marks of Walter Kidde & Company, Inc. and its associated companies.

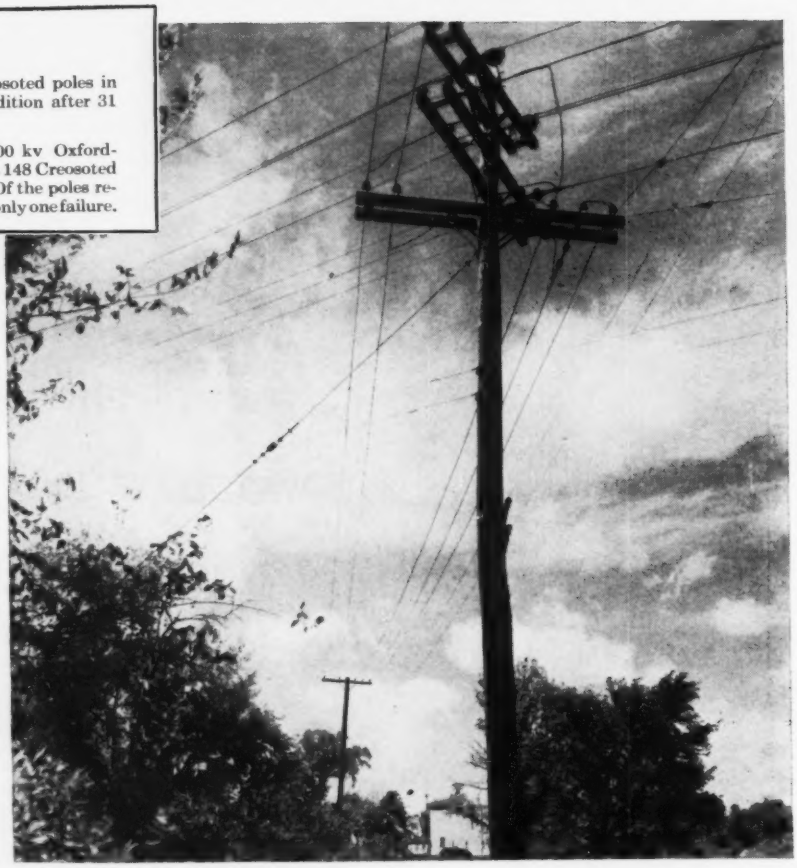


. . . Here's Proof of Performance

A MICHIGAN ELECTRIC COMPANY REPORTS: 425 CREOSOTED POLES INSTALLED IN 1922 . . . ONLY ONE REMOVED FOR DECAY

THIS CLOSE-UP of one of the Creosoted poles in the line shows its excellent condition after 31 years of service.

DETROIT EDISON COMPANY'S 24,000 kv Oxford-Romeo transmission line includes 148 Creosoted poles that were installed in 1922. Of the poles removed, decay was responsible for only one failure.



In 1922, Detroit Edison Company installed a 14-mile 24,000 kv transmission line between Oxford and Romeo, Mich., using 425 poles treated with Creosote. Thirty-one years later, 148 of the original poles are still in the line.

But of the 277 removed, *only one was taken out because of decay.* The others were removed because of road widening, residential and industrial construction, automobile accidents and storms. And many of the poles removed were reused in other locations.

In the Detroit Edison System—which has over 600,000 poles—nearly three-fourths are treated with Creosote. Their Supervising Engineer of Inspection and Standards points out, "Creosote is an excellent preservative with an enviable service record. It offers absolute reliability, great lasting power and adequate cleanliness for pole use."

The Creosoted poles are southern pine and cedar, and company officials say southern pine poles wouldn't last five years without Creosote, but they'll last 30 to 60 years with it.

Service records like this are important to you because they prove the time-tested effectiveness of Creosote as a wood preservative. Its toxicity and permanence have made it first choice among users of treated wood.

For the finest pole and crossarm performance always specify U·S·S Creosote, the uniform product of continuous processing in America's largest tar distillation plant. For complete information, contact our nearest Coal Chemical sales office or write directly to United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

U·S·S CREOSOTE

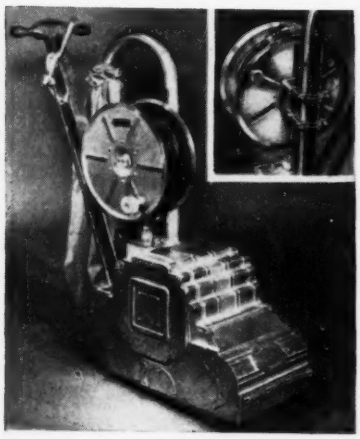
3-1682

UNITED STATES STEEL

other leg. This motion relaxes tension in the struts breaking electrical contacts.

Operating range of the unit is −65F to 175F with a room temperature sensitivity from 0.25 to 1 fps. Internal heater draws 35 w at 28 v, ac or dc; a 115-v model will also be available. Control circuit is rated at 5 amp at 115 v ac, or 2 amp at 28 v dc.

Fenwall Inc, Ashland, Mass.



Electric Cord Reel

A new electric cord reel, called Port-O-Reel, has been developed that attaches to the frame of portable power equipment. The reel has a built-in dust-tight collector ring which permits continuous flow of electrical current as reel is turned. A free turning knob provides for easy winding, and the reel is equipped with an adjustable brake and lock.

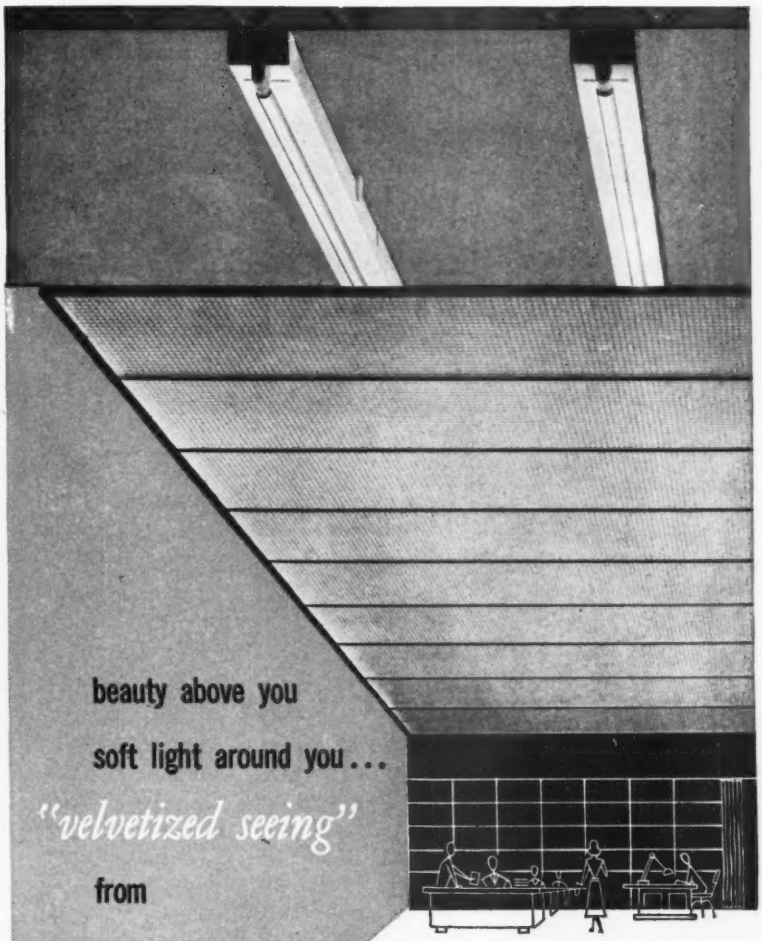
Reels are applicable to portable power equipment using up to No. 12 three-conductor cord. They will hold up to 150 ft of No. 16 two-conductor cord.

Industrial Electrical Works, Omaha 2, Nebr.

Pressure Devices

Two new Autronic packages for controlling or recording, or both, differential pressures or flow have been announced. Heart of each package is an electronic Type D2T differential pressure transmitter that covers a range of from 0-20 to 0-200 in water at static pressures up to 5,000 psig.

The recording package consists of the transmitter, a Type A2R miniature



GUTH GRATELITE* CEILINGS

covered from wall to wall with GrateLite, the diffusing plastic louver . . . an architectural dream.

Diffusion through 3/8" translucent cubical facets produces finer quality illumination . . . fills the room with soft light for "VELVETIZED SEEING". It keeps your eyes "at rest" and makes your work easier.

simple installation: Just 5 parts to handle.

easy maintenance: Relamp by removing only 1 panel. Panels can be detached and washed in 2 minutes . . . just shake in detergent water.

Start a new era of eye comfort—with up to 200 foot-candles! Write today on your letterhead for folder 905-H and GrateLite layout guide.

Guth

THE EDWIN F. GUTH CO. ST. LOUIS 3, MO.

*U. S. & Can. Pats. Pend.
Trademark Registered

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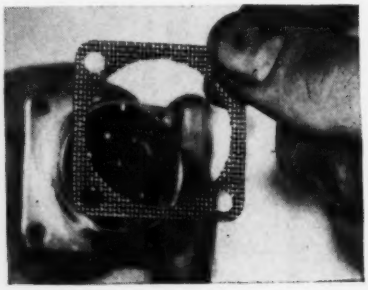
COST DOWN
Artie One-step
WITH
RTE
(artie)
ONE-STEP
RT&E Co.'s
VOLTAGE
REGULATOR
GET
LOW COST
REGULATION
Extend the load life of your distribution lines to their fullest before you spend large sums of money on re-conductoring, rephasing, and adding substations.
R T & E's "Artie" One-Step Regulator is the quickest easiest, and most economical way yet devised to correct voltage drop and increase the load life of your lines.
In less than 24 hours you can engineer line requirements, locate regulator position, and install "Artie" One-Step Regulators in service.
Be smart—do it the R T & E way.
For complete details on operation, construction, and installation, write for booklet "OSR-1."
632 N. 8TH ST.
MILWAUKEE 3,
WISCONSIN
RT&E Co.
BRANCH PLANT:
WAUKESHA,
WISCONSIN

strip chart recorder, and a constant voltage transformer. The controlling and recording package includes these units as well as a Type A3C controller with proportional band and automatic reset, a M2C manual control, and a P2R power relay.

Advantages claimed for these packages include: Accurate and instantaneous response, negligible zero shift, unrestricted location of components, flexibility, and interchangeability of components.

Swartwout Co, Cleveland 12, Ohio.



Gasket Material

A new, highconductive gasketing material is available for shielding radio equipment. It is said to be effective under difficult conditions of high receiver sensitivity and low signal strength.

The material consists of aluminum wire screening whose interstices are filled with neoprene. Both material surfaces are buffed to insure uniform gage and smoothness, and to expose the aluminum wire for good electrical contact. Dimensional stability and resistance to deterioration are said to be provided by this combination.

Material can be supplied either in the form of cut gaskets or as uncut sheets 15 x 19 in.

Vulcanized Rubber & Plastics Co, Morrisville, Pa.

Entrance Fittings

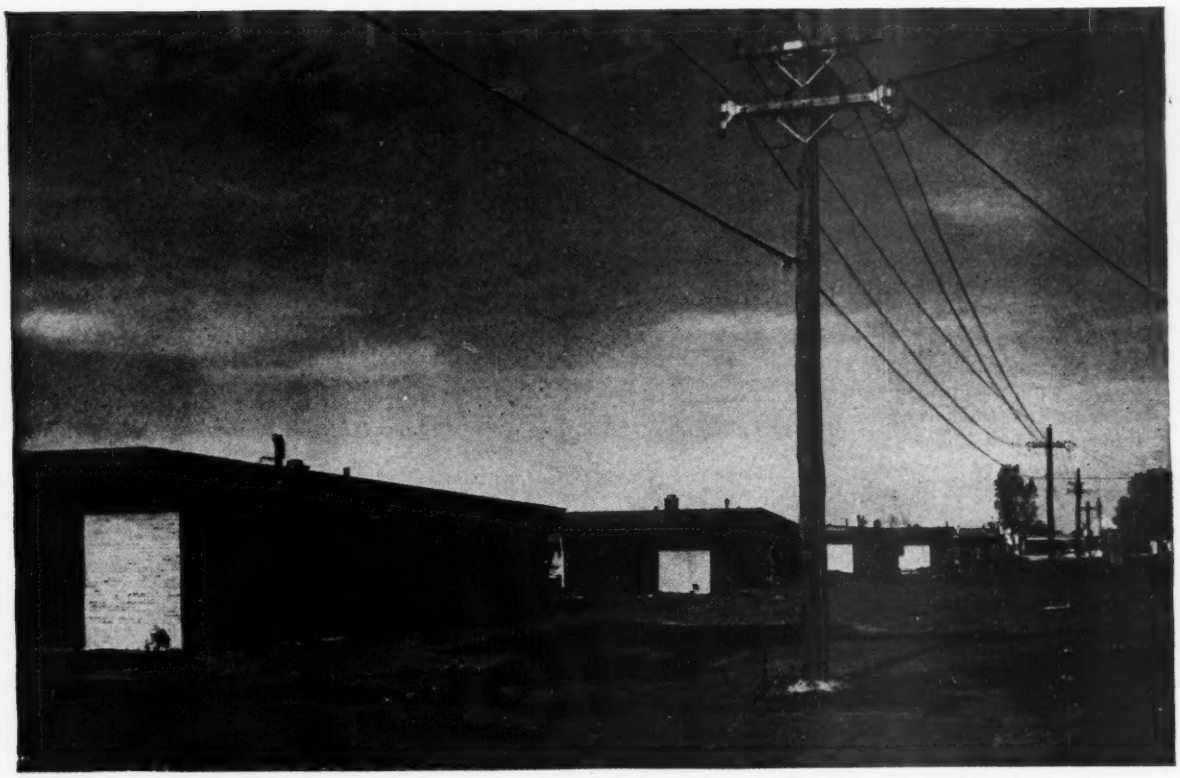
Two service entrance fittings have been announced. One fitting, a service entrance cap designed to accommodate three No. 2 service cables, is said to feature increased capacity. The other fitting, featuring product simplification, is a water-tight connector for service cable.

Moisture-proof connections are said to be insured with cable connectors

DOW

CLEAN POLES MAKE FAST FRIENDS

PENTA builds good customer relations



PENTA pressure treated Southern Pine poles installed in the Chicago area.

The Dow Chemical Company
Dept. PE3-2B1-B, Midland, Michigan

_____ Send me free booklet, "Pointers on Penta."

_____ Send me list of PENTA treating plants.

_____ Please have technical representative call.

Name_____Title_____

Company_____

Address_____

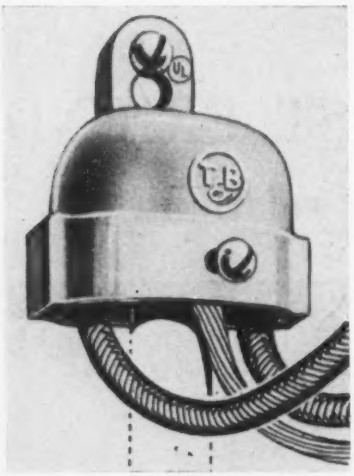
City_____State_____

Poles treated with *clean* PENTA* are being placed in many new residential areas by the Illinois Bell Telephone Company. They are playing their part in this company's far-sighted customer relations program. *Clean* full-length PENTA treatment for poles and cross-arms reflects sound management. Since PENTA lengthens wood life many times, it cuts repair and maintenance costs to save you money. Poles treated with PENTA are clean and easy to handle—a modern method of wood treatment for modern settings.

Over 60 suppliers across the nation can furnish you with PENTA-treated poles. Be sure to ask your regular supplier about *clean* *PENTAchlorophenol or write direct to THE DOW CHEMICAL COMPANY, Midland, Michigan.

you can depend on DOW CHEMICALS

DOW

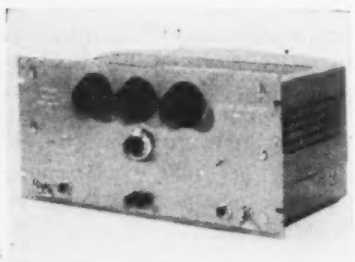


because they are designed with long take-ups, which results from a long metal body with more inside taper, and mating rubber bushings of similar shape. The long length, the company says, halves the number of connectors required to cover the range of cable sizes. Product simplification is further aided by color coding bushings, it is claimed.
Thomas & Betts Co, Elizabeth, N. J.

Rheostats

For industrial control applications, the rheostats are claimed to feature a balanced contact arm keyed directly to drive shaft, self-lubricating bushings and graphitized movable contact shoes, and Vitrohm enamel that seals the resistance element, stationary contacts and collector rings.

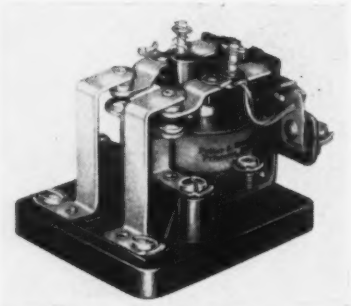
They are available in 6-, 8-, and 13-in. diameters with maximum ratings of 330, 450 and 1,000 w. Control steps per plate range from 41 to 161.
Ward Leonard Electric Co, Mount Vernon, N. Y.



Dc Source

A dc reference source that produces a calibrated voltage essentially independent of input line voltage and output load variations has been announced. Its circuit compares the output voltage against the internal standard cell to insure calibration and stability.

Output voltage is from 1 to 300 v, variable in 1-v steps, and variable between steps by calibrated potentiometer. Output current is 5 amp max. Accuracy of Model 123 is 0.1%. Accuracy of Model 123 Y is 0.01%. Power requirements are 105 to 125 v, 75 w.
Kalbfell Laboratories, San Diego, Calif.



Relays

A redesigned line of PR heavy duty power relays has been announced. The entire series is being equipped with one-piece molded plastic bases with reinforced molded contact support integral with base, to afford good insulation and rugged service.

PR 4, 8, and 11 relays have an insulating barrier molded to the base between stationary contacts for additional leakage path. All relays have 1⅞-in. mounting centers.
Potter & Brumfield, Princeton, Ind.

Fire Extinguisher

A new 1-qt, trigger-operated fire extinguisher has been announced for protection against Class B and C fires. Alfco Model PCB-1 is a stored pressure unit charged with bromochloromethane, commonly known as CB liquid.

The unit is light-weight, designed for one-hand operation, and can be aimed like a gun. Trigger can be worked easily by operators wearing heavy work gloves. For repressurizing, a standard air chuck may be used.
American - LaFrance - Foamite Corp, Elmira, N. Y.

MORE NEW PRODUCTS
about which you should know

Eagle Electric Mfg. Co, Long Island City 1, N. Y., has an all rubber **weather proof socket,** with two short leads, rated at 660 w, 250 v.

Tempo Products Co, Cleveland 3, Ohio, announces the redesign of their **electric hammers** that weigh 7½ lb and produce 3,000 blows per min . . . Haydon Switch Co, Waterbury, Conn., has a new hermetically sealed precision **snap switch** rated at 10 amp, 115v, 60 to 400 cps.

G. M. Giannini & Co, Inc, Pasadena, Calif., announces a multi-channel, rotary, mechanical, high-speed **switching commutator** designed for use in radio and wire telemetering, multichannel switching, and automatic rate sampling . . . Appleton Electric Co, Chicago, Ill., has a new **utility wrench** for assembly of thin-wall fittings, and combining de-burring and non-slip tightening in one tool.

Curtis Development & Manufacturing Co, Milwaukee 16, Wis., announces enclosed **terminal blocks,** rated at 300 v at 15 amp, with from one to 14 terminals per block . . . Minneapolis-Honeywell Regulator Co, Freeport, Ill., has new precision **snap-action switches** designed for one-way actuation by cams, dogs or slides, which are rated 15 amp, 125, 250 or 460 v ac.

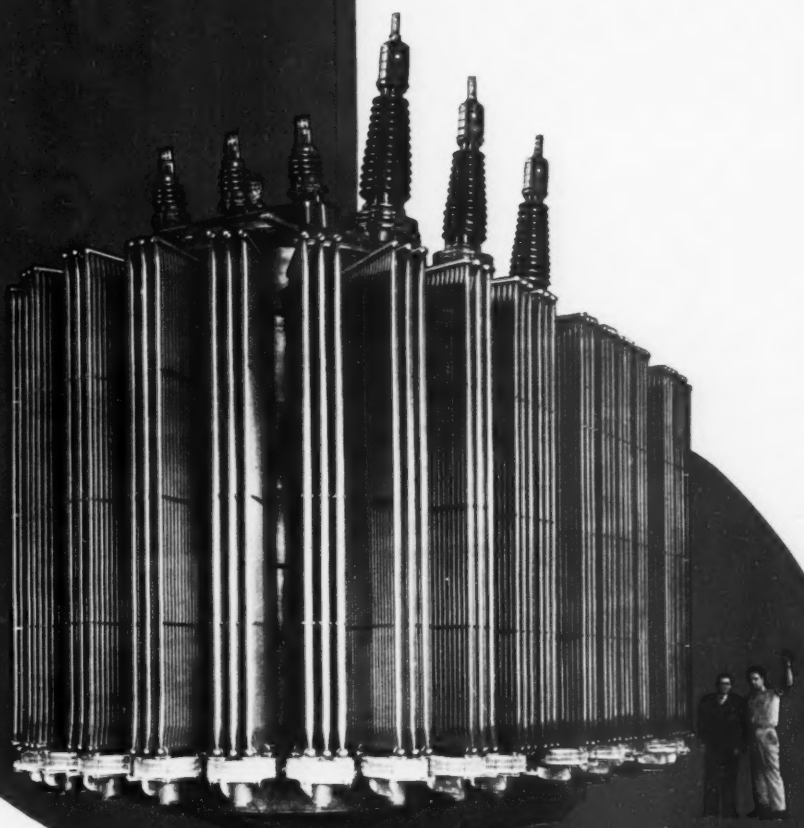
Addressing Machine Co, San Francisco, Calif., announces **paper index cards** in continuous form for insertion into addressograph frames, which are said to be prepared very fast . . . Sub-Zero Products Co, Cincinnati 29, Ohio, has high and low **temperature testing units** in capacities from 1 to 4 cu ft, for temperatures from 250 to —130 deg.

Buchanan Electrical Products Corp, Hillside, N. J., announces heavy-duty molded **terminal blocks** with non-separable hinged covers, in either screw or solderless types, and in 4, 6, 8, or 12 circuits sizes . . . Lindell Electric Control Corp, New York 13, N. Y., has a **capacitor tester** with selection ranges from 0-0.1 to 0-1,000 microfarads.

60,000 KVA

Three Phase

PENNSYLVANIA POWER TRANSFORMER



This three-winding auto transformer has a forced-air-cooled rating of 60,000 Kva and a self-cooled rating of 48,000 Kva. It is designed to take the full capacity of the generator on the 13,200 volt delta tertiary winding and step up the voltage to either 132,000 volts or 67,200 volts, or to both simultaneously. If the generator is out of service, the transformer permits full capacity transfer between the 132,000 volt and 67,200 volt systems through the auto connection in the high voltage winding.

PENNSYLVANIA
TRANSFORMER COMPANY
A McGRAW ELECTRIC COMPANY DIVISION
CANONSBURG, PENNSYLVANIA
Greater Pittsburgh District

SEE NEXT PAGE FOR INSIDE STORY

INSIDE A *60,000* KVA *Three Phase* PENNSYLVANIA POWER TRANSFORMER

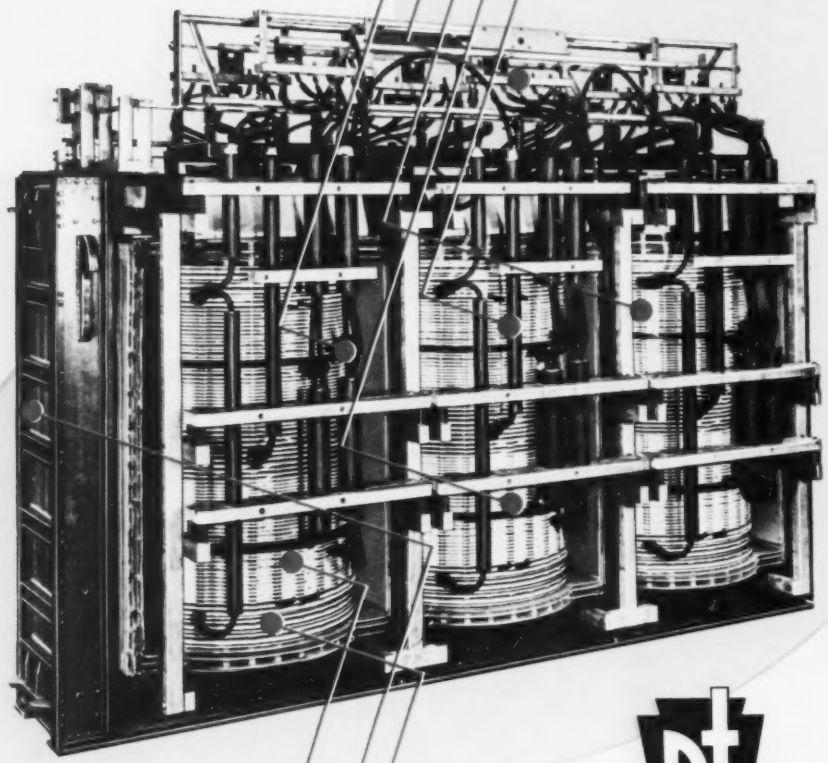
Two sets of taps per coil assure excellent electrical and mechanical balance in the windings.

Tap changer located above core and coils for easy access through cover of transformer.

Continuous pancake winding in High and Low Voltage coils. Helical winding in Tertiary coils.

Taps are located in the High Voltage windings (132,000 volts) as well as the Low Voltage windings (67,200 volts).

All leads are well supported and insulated in heavy pressboard tubes.



Coils are precompressed with a force equal to the highest short circuit stress and built into transformer at that compressed dimension. This prevents mechanical distortion of the coils if short circuit stresses occur.

Five-legged core reduces shipping height.

Extra heavy insulation at line ends of coils. Graded insulation at ground ends of coils.

For exterior view of this transformer, see other side.

60,000 Kva forced-air-cooled/48,000 Kva self-cooled. Three phase, 60 Cycles, 55°C. Temperature rise. High Voltage: 132,000 Grd. Y. volts. Low Voltage: 67,200 Grd. Y volts. Tertiary Voltage: 13,200 Delta volts.

Weight of complete transformer filled with oil — 356,700 pounds.

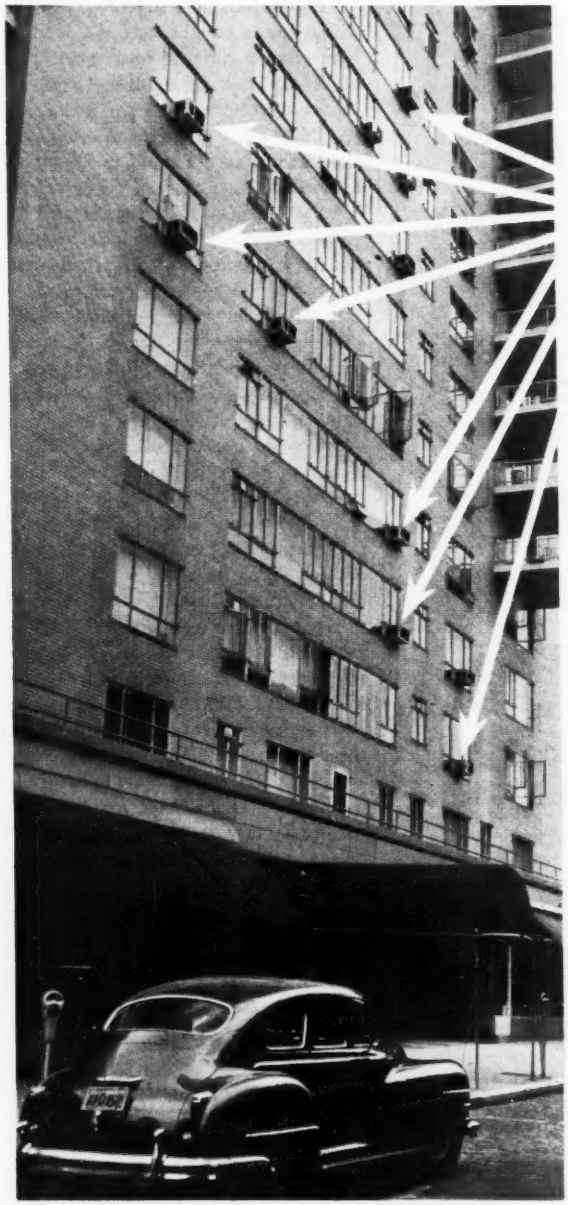
PENNSYLVANIA TRANSFORMER COMPANY

A McGRAW ELECTRIC COMPANY DIVISION

CANONSBURG, PENNSYLVANIA

Greater Pittsburgh District

LETTERS TO THE EDITOR



Comments on Room Coolers

To the Editor:

On the front page and on page 86 of your July 27 issue are statements with which I should like to take issue.

I believe that no new electrical utilization on devices such as room coolers should be regarded as a *headache* by utilities. Rather it, along with its problems, should be regarded as a challenge. Within my short association with the electrical business there have been cries of horror by utility engineers upon the introduction of new devices. These include fluorescent lights, television, electric home heating, clothes driers, and others. I rather imagine that during the 20's and 30's when refrigerators, ranges, and water heaters were becoming popular that similar cries of alarm rose.

The final result of all these devices has in all cases meant more electricity and better living for less cost. So let us look at room coolers with an optimistic eye for a moment.

When our distribution facilities become overtaxed by room coolers, it does not mean that we must rebuild and heavy up for the room coolers, but rather it means that we merely advance the day that we must heavy up anyway. Should we have to spend the money to run in a third wire to serve a customer's air conditioning when a two-wire service is otherwise adequate, let us remember that both our work and the customer's new service entrance will make it that much easier to make a range and water heater sale.

Another reason for encouraging the sale of air conditioning of all kinds is that it is one more step in the direction of "all-electric living." Many electrical appliances start a "chain reaction," and air conditioning is one of these triggers.

So rather than discourage room coolers or take either a negative or neutral attitude, let us borrow one of your own expressions and "Sell and Sell and Sell . . ."

C. E. Bryan
Chief Engineer

Jackson Electric Department
Jackson, Tennessee

To the Editor:

My congratulations to F. G. Hamner and Electrical World for a most timely and searching article on "Today's Problems of Serving Room Coolers."

The suggested solutions point up very strongly the conflicting interests of electric utility, manufacturer, and customer. There is no doubt in my mind, however, that the ultimate solution will be in the best interests of all concerned. The missing ingredient is simply equipment ultimate design and that is due to appear shortly.

G. M. Damon
President

Heat Pumps, Inc.
Pittsburgh, Pa.

To The Editor:

Your editorial on page 77 and the article, "Today's Problems of Serving Room Coolers," by F. G. Hamner, appearing in the July 27 issue of Electrical World, was of great interest. The subject is one that has been troubling the utility companies in the South for several years and is just beginning to be felt by some of the northern companies.

For the past two years EEI has been studying this problem through its T&D, Rate, and other committees. The EEI-ACRMA-NEMA-REMA Joint Committee on air conditioning and refrigeration equipment has devoted considerable attention to the subject for the past two years in particular.

At the Chicago meeting of EEI's T&D Committee, May 5 and 6, three papers were presented on this subject. It seems rather significant that the 14 Southern utilities polled by Messrs. Brady and Scott were unanimous in their concept of the problem and their belief that all air conditioning equipment should be required to have a power factor of 90% or better. Since these 14 companies serve a total of

transformer, see other side.

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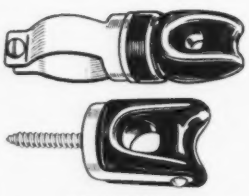
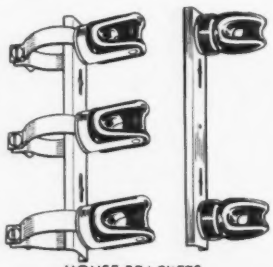
The most complete line of quality secondary service materials available

Every design conforms with industry standards. Racks and house brackets are double hot-dip galvanized for longer service. Wireholder screws are sharp and clean, for quick, easy driving. Dense, homogenous porcelain gives top strength, highest insulation value and sparkling appearance. Your lineman and your budget will like the ease of installation—and the quality—of Porcelain Products' secondary service materials. Write us for complete details.



WIREHOLDERS
Standard and pipe-mounting

SECONDARY RACKS
Solidly constructed for longer service



HOUSE BRACKETS
Standard and pipe-mounting

FOUR-IN-ONE SPOOLS
A wonderful new product

SPOOLS

CLEVISES
For every application

Porcelain Products, Inc.
FINDLAY, OHIO

3 million meters, they represent a sizable segment of the industry.

Hamner has presented an excellent discussion of many facets of this problem. Based on our own experience and study however, the following comments are offered.

• No ¾ hp, or larger, room cooler should be treated as a plug-in device for residential use. In 90% of alleged low voltage trouble calls involving 115-v units, we have found customer wiring inadequacy is the cause of trouble. If 230-v units, only, are sold for residential use, a special circuit is necessary from the distribution panel to the point of use and customer wiring adequacy is usually obtained. To efficiently use a 115-v unit in a residence, a special circuit of adequate size should be installed. The cost for a special 230-v circuit should be no greater, and a better load balance would result within the customer's wiring.

• To the best of our knowledge, no utility company makes any charge to the customer for providing a three-wire service versus a two-wire service. Of course, the customer has some expense of his own in providing a three-wire meter loop and service entrance, which is a part of his wiring installation. In the South, we find that few customers stop with one room cooler, but install additional units during successive seasons. It is questionable in our mind that a two-wire service, or 115-v units should ever be used in residences with multi-unit air conditioning installations.

Many motor driven major appliances in residential use possess inherently low power factor, such as washing machines, refrigerators, dishwashers, fans, and many others. These items have not presented particularly severe problems with respect to reactive component on utility systems because of: (a) their relatively small individual magnitude; (b) the high degree of diversity in their use; and (c) the short duration of most operating cycles for such equipment. Nor has the customer's wiring suffered unduly from these items of load for the same reasons. Residential air conditioning, on the other hand, presents an entirely different situation: (a) Having bought a comparatively expensive item, the customer wants to enjoy it and therefore keeps it turned on; (b) When hot weather hits, all diversity is lost and every unit runs continuously; (c) Even the window air condi-

tioning units are a larger item of load than probably any other motor driven appliance in the home. Most of the motor driven residential appliances are in use year round, whereas air conditioning equipment is a highly seasonal item of load.

• Most utilities are installing both switched and unswitched static capacitors at locations and in quantities dictated by engineering calculations and board studies. This practice will continue for system betterment and stability. However, it would appear inequitable for a utility to install sufficient correction for residential air conditioning and assess the cost against all residential customers, when many of them may never enjoy the comfort of air conditioning. The paper bag at the grocery store is not a good analogy, because every customer is furnished one or more of sufficient size for his purchases and pays for it in direct proportion to his use; the larger the purchase the larger the bag. If 75% of the grocery store customers were not furnished bags and the cost of supplying bags to the favored 25% was spread over all customers, it would be called a discriminatory practice.

• It is generally recognized that the best place to correct poor power factor is at the source and in such a manner that it can be switched with the load producing poor power factor. If integral horse power size motors can be sold for the same price, whether high or low power factor, it would seem reasonable to assume that high power factor fractional horse power size motors could be supplied at the same cost as low power factor ones, if there were sufficient demand for them. If, in the case of hermetics, external static capacitors must be used and all manufacturers use them, competitive pricing relationships would remain the same.

It has been interesting to find that many of the northern companies who heretofore have not felt the impact of residential air conditioning loads are this summer beginning to recognize the seriousness of the problem and are voicing some concern over the low power factor and urging the adoption of 230 volt units, only, for residential use.

R. F. Scott
Asst. Div. Mgr.
Southwestern Gas & Electric Co
Shreveport, La

service
service
service

NEWS ABOUT PEOPLE

Pennsylvania Power Elects . . .

. . . Charles Bowden executive vice president and Paul G. Dingledy a VP. Sammis resumes presidency of utility

CHARLES S. BOWDEN

New executive officers have been appointed by Pennsylvania Power Co, a subsidiary of Ohio Edison Co. The appointments are effective Nov. 1.

Charles S. Bowden, general superintendent of power production for Ohio Edison, will become executive vice president of Pennsylvania Power, a newly created post. Paul G. Dingledy, assistant to the president of Pennsylvania Power, will assume the post of vice president of the Pennsylvania company.

Walter H. Sammis, chairman of the board of Pennsylvania Power Co, will resume the presidency of the utility following the retirement of Louis B. Round. Sammis, who is also president of Ohio Edison and Edison Electric Institute, previously served Pennsylvania Power as president from 1936 until 1950. Round, who was elected president in 1950, will continue as a director of the Pennsylvania utility.

Two Others Reassigned . . . In other appointments, John W. Mikels, superintendent of Pennsylvania Power's New Castle plant, will take over as superintendent of power production for Ohio Edison to replace Bowden. C. G. McConnell, assistant superintendent of Ohio Edison's plant at Toronto will succeed Mikels at New Castle.

Bowden, who has been engaged in public utility work for 30 years, was serving as production manager and assistant to the vice president in charge of operations for Ohio Public Service Co when it was acquired by Ohio Edison in 1949. At that time he was named general superintendent of transmission and substations of Ohio Edison, becoming general superintendent of power production in 1950.

Elected a Director in 1951 . . . Dingledy has been associated with Pennsylvania Power and affiliated companies since 1925. He started as a test engineer for Pennsylvania-Ohio Power & Light Co at its Toronto Plant and a year later was made lighting engineer for Pennsylvania Power at Greenville. He became assistant to the vice president and general manager of Pennsylvania Power in 1931, assistant to the president in 1950, and a director of the company in 1951.

Round, who has been in the public utility field almost 46 years, served Pennsylvania Power as vice president and general manager for a number of years before assuming the presidency in 1950.

PAUL G. DINGLEDY

CARL J. FORSBERG

Forsberg Elevated

Wisconsin P&L advances former Lake Geneva district manager to vice president

Carl J. Forsberg, district manager at Lake Geneva for Wisconsin Power & Light Co, has been elected vice president in charge of operations for the utility.

Forsberg joined Wisconsin P&L in 1934 as industrial engineer at Madison, and later served as commercial sales supervisor there. In 1939 he was named district sales supervisor at Sheboygan, and two years later was promoted to district manager at Lake Geneva. Prior to joining Wisconsin P&L he worked in the power sales department of Public Service Co of Northern Illinois.

•

M. L. Carmichael, formerly manager at Bedford for Public Service Co of Indiana, Inc, has been appointed district manager at Lafayette. He will be succeeded by **R. B. Pearson,** manager at Mitchell since 1938. **V. W. Taylor** will replace Pearson at Mitchell and **Emmer Randolph** becomes manager at North Manchester.

Clarence M. Clark has been appointed manager of Westinghouse Electric Corp's Electronic Tube Division plant at Bath, N. Y. Clark, who has been manager of accounting at division headquarters at Elmira, N. Y., joined Westinghouse 27 years ago.

Executive Changes

Walter C. Schoeppe and Hugh McKean are made vice presidents of Florida Power

Florida Power Corp has elected two new vice presidents. They are: Walter C. Schoeppe and Hugh McKean.

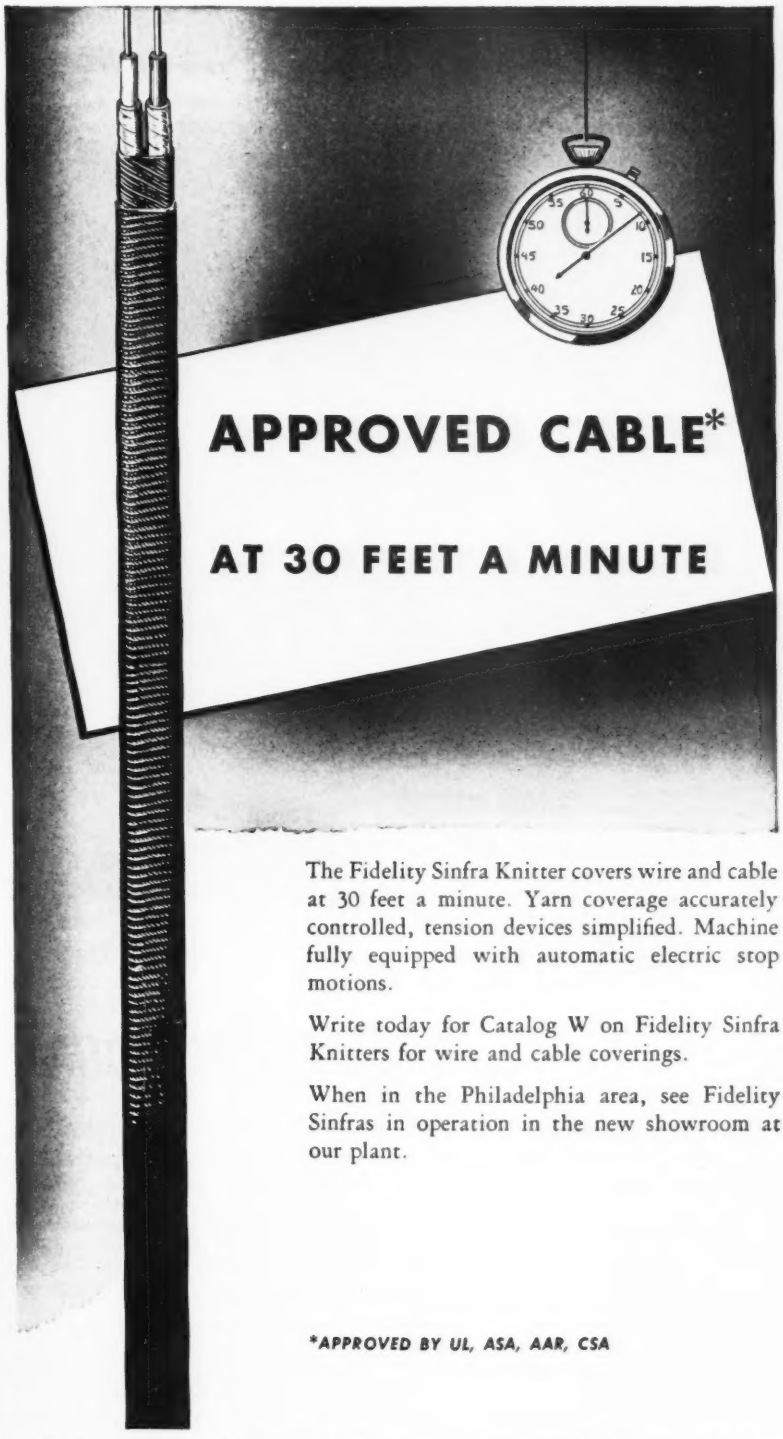
A veteran of 33 years in the utility field, Schoeppe was serving Florida

WALTER C SCHOEPPE

Power as comptroller until this new appointment. He has been with the utility 26 years and a director 15 years.

McKean became affiliated with Florida Power in 1946 after 18 years' experience with Indiana utilities. Prior to his new assignment he was general superintendent of the companys' operating departments.

HUGH McKEAN



The Fidelity Sinfra Knitter covers wire and cable at 30 feet a minute. Yarn coverage accurately controlled, tension devices simplified. Machine fully equipped with automatic electric stop motions.

Write today for Catalog W on Fidelity Sinfra Knitters for wire and cable coverings.

When in the Philadelphia area, see Fidelity Sinfras in operation in the new showroom at our plant.

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Designers and Builders of Intricate, Automatic Precision Machines

FIDELITY MACHINE COMPANY, INC.

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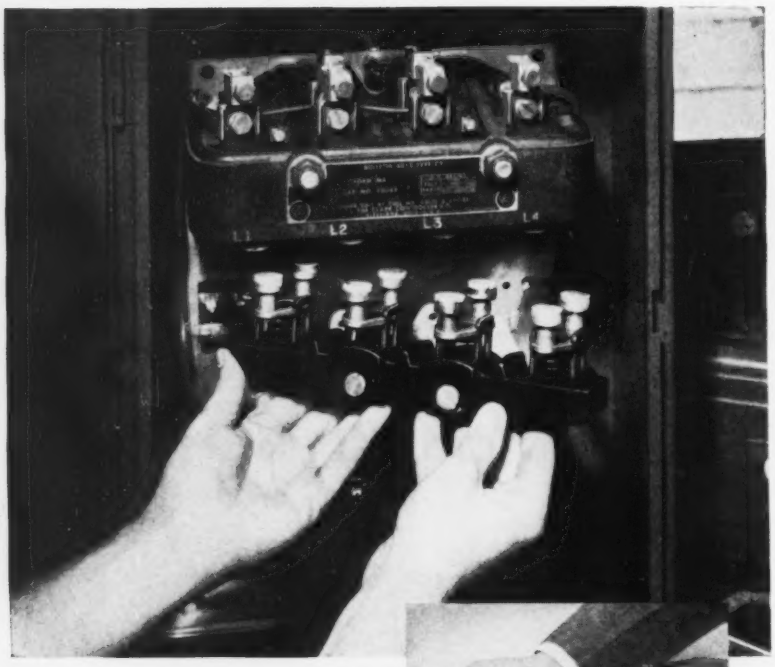
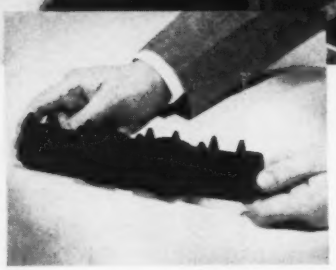
Another new development using

B. F. Goodrich Chemical *raw materials*





Motor starter unit made by The Clark Controller Company, Cleveland, Ohio. Hycar rubber-phenolic compound supplied by Durez Plastics & Chemicals, Inc., North Tonawanda, New York. B. F. Goodrich Chemical Company supplies the Hycar rubber only.

Add Hycar ...Subtract Breakage!

IN testing experimental models of the heavy-duty, 4-pole magnetic motor starter pictured, breakage sometimes occurred with the contact arms.

This was a job where Hycar American rubber could help, as it has on so many similar problems. Hycar was added to the phenolic resin molding compound. It provided the required impact strength and shock resistance. The experimental contact arms worked perfectly—breakage was eliminated. Full-scale production was started.

But Hycar does even more. It also provides high dielectric strength; the molding compound is electrically safe.

Hycar-phenolic compounds are noted for their exceptional shock-resistance —2 to 5 times that of conventional phenolic compounds. They simplify operations, too. In processing, they provide good molding characteristics . . . easy flow in the mold . . . resistance to cracking around metal inserts in the part.

Hycar is highly versatile. It is used as a modifier for phenolic resins . . . as a base material . . . as an adhesive base . . . as a latex for coating or impregnating. Perhaps one of the many Hycar compounds can help you improve or develop more saleable products. We'll help with technical advice. For information, please write Dept. GJ-9, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

B. F. Goodrich Chemical Company
A Division of The B. F. Goodrich Company

Hycar American Rubber

GEON polyvinyl materials • HYCAR American rubbers • GOOD-RITE chemicals and plasticizers • HARMON colors

Robert H. Beisswenger has joined Indiana Steel & Wire Co, Muncie, Ind., as manager of sales of electrical materials. Beisswenger, formerly affiliated with Philadelphia Electric Co, was associated with Silvray Lighting, Inc, as a field representative prior to forming his own representatives' sales agency.

Russell W. Becken, division engineer at Jamestown, N. D., for Otter Tail Power Co since 1949, has been appointed construction superintendent for the company with headquarters at Fergus Falls, Minn. Replacing Becken as Jamestown Division engineer is **Frederick J. Fischer,** engineer in the general office electrical department in Fergus Falls.

Andre Dubus, Lafayette, La., district superintendent for Gulf States Utilities Co, Beaumont, Tex., since 1943, has been made superintendent of the Lake Charles, La., district. **J. Roy Peckham,** superintendent of the utility's Gulf district with headquarters at Beaumont for the past three years, assumes Dubus' former post at Lafayette.

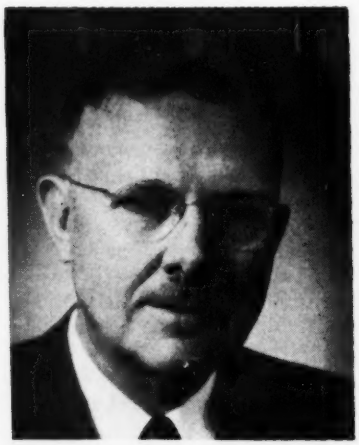
OBITUARY

Bernard M. Kirsch

Bernard M. Kirsch, 53, former director and vice president in charge of sales for Pennsylvania Electric Co, died Aug. 23 at Bradford, Pa.

Kirsch was associated with Westinghouse Electric Corp and Conduit Electric Supply Corp, Syracuse, N. Y., before going in 1930 to Bradford

Electric Co as commercial manager. In 1937 he was elected president. He resigned four years later to become vice president and general manager of Erie Lighting Co and vice president and a director of Penelec with headquarters at Erie. In 1943 he was made vice president of Penelec's Northern Division and three years later was named vice president in charge of sales. He retired from the latter post in September, 1952.



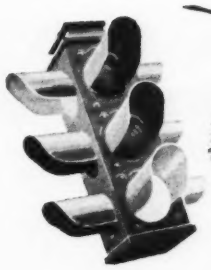
Fred T. Whiting

Fred T. Whiting, 63, vice president in charge of Midwestern operations for Westinghouse Electric Corp, died Aug. 20 while on a fishing trip in British Columbia.

Whiting, who graduated from Iowa State College in 1913 with a BS degree in mechanical engineering, joined Westinghouse that same year. Since then he served the company as a steam turbine sales engineer, manager of the engineering department, and manager of the industrial department. In 1930 he was placed in charge of apparatus sales and overall responsibility for every Westinghouse activity in six states and parts of three others in the Midwest. He was elected a vice president of Westinghouse in 1943.

•

E. Parish "Pat" Lovejoy, 53, former director of the Public Information Department of Detroit Edison Co, died Aug. 14 at Beaufort, S. C. Lovejoy joined the engineering staff of Detroit Edison in 1929 after serving General Electric Co for six years. He was appointed to the director's post in 1947, and relinquished his duties more than a year ago because of illness.



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Murray Gill Station*

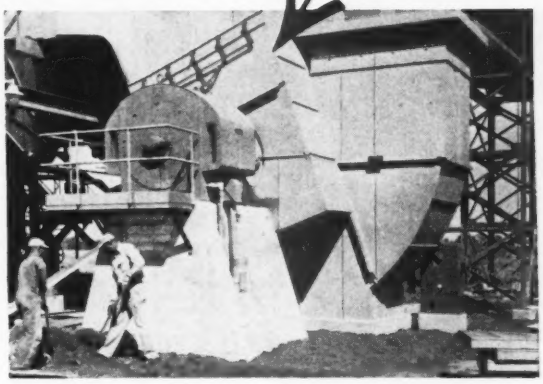
Kansas Gas and Electric Company

Wichita, Kansas

GREEN
Double Inlet ID Fan

Design capacity 256,500 cfm @ 383°F. 28.65" Bar; 10.16" SP; 705 RPM 595 HP. Special control type louvre inlet dampers; outlet dampers; inlet boxes; air-cooled bearings and sun shields.

The installation includes a Green Forced Draft Fan.



*Designed by Ebasco Services Incorporated

Two exacting buyers were involved in this installation: the owners and the consulting-design engineers. That they have entrusted to Green Fans the important work of supplying combustion air is in itself a stamp of approval. Their decision might be helpful to you in selecting fans for your power plant project.

We have been designing and making draft fans for 48 years. This is indicative of our experience. We have supplied fans for many of the leading utility and industrial power plants now under construction or recently completed. This is indicative of our modern designs and fabricating methods.

Our Catalog No. 168 tells all about Green Fans. Write for a copy.

THE GREEN Fuel Economizer COMPANY INC.

- Economizers
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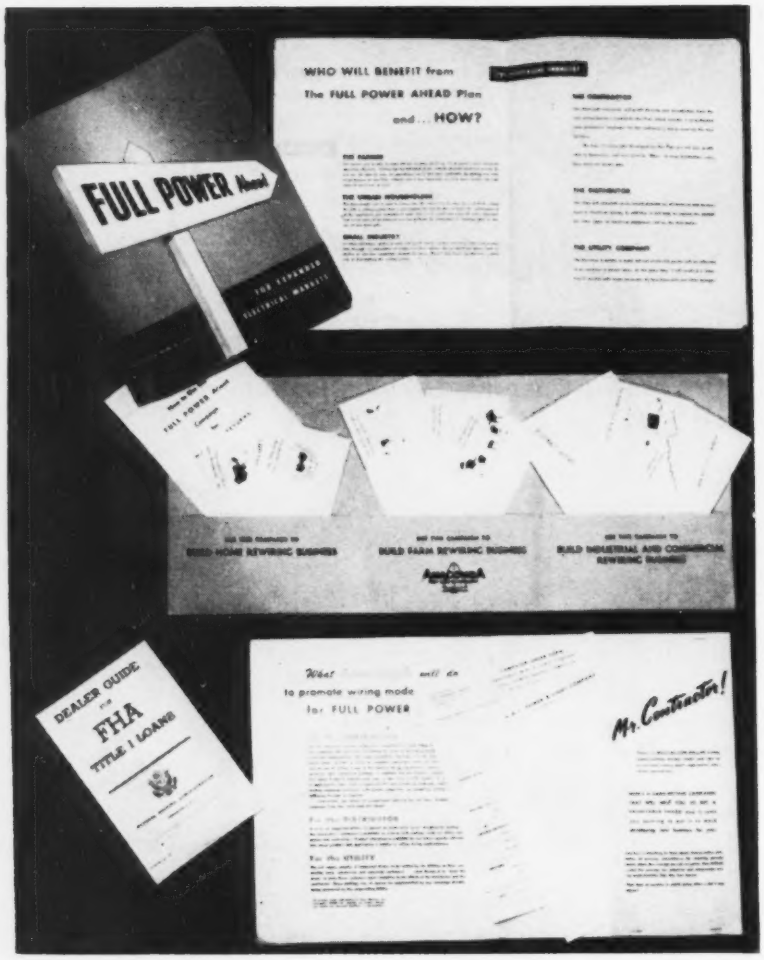
MANUFACTURERS & MARKETS



ANACONDA's "Full Power Ahead" campaign advocates better wiring for farm, home, and industrial and commercial businesses.

Adequate Wiring Program . . .

. . . is launched by Anaconda W&C. 'Full Power Ahead' campaign aids utilities, electrical contractors and distributors

Anaconda Wire & Cable has launched its "Full Power Ahead" campaign in behalf of utilities, electrical contractors and distributors. The company's promotional package is designed to secure better-than adequate wiring on the farm, in the home, in small industry, and in commercial enterprises.

"Full Power Ahead" is a 16-page brochure which shows the simple, step-by-step way each group—utility companies, contractors, and distributors—can organize cooperatively in the interest of better business all around. It also includes data on how to finance wiring modernization work by property improvement loans insured under "Title I" of the National Housing Act.

Tool Kit . . . The brochure also contains a "tool kit" equipped with sample direct mail pieces and complete details for the utility, contractor, and distributor to wage a successful direct mail campaign to accomplish the following:

1. Build home rewiring business
2. Build farm rewiring business
3. Build industrial and commercial rewiring business.

As part of the program, Anaconda offers, under a fictional "A. B. C. Power & Light Co" letterhead, a suggested letter to farm, residential, industrial, and commercial customers of the utility showing each group how the utility can help them combat "under voltage," and inviting their help on electric service problems.

Anaconda's campaign attacking obsolescent wiring is designed to reap the following benefits:

For the Utility . . . A substantial increase in domestic, commercial, and industrial power sales, and a sharp decrease in service calls.

For the Distributor . . . Increased sales of all materials and devices used in electrical wiring, and expanding markets for other types of electrical equipment.

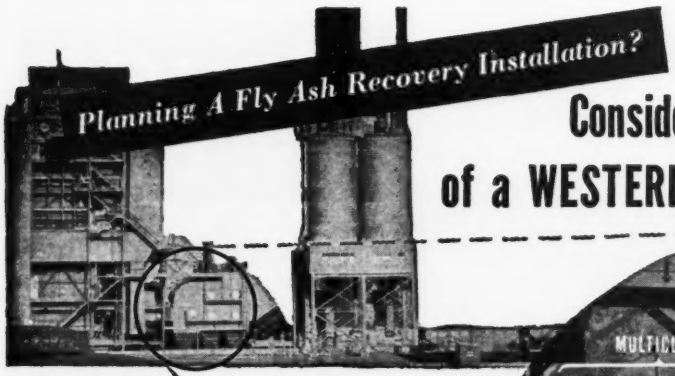
For the Contractor . . . A substantial increase in wiring and other business which will provide jobs to keep installation crews busy in between bigger jobs.

MANUFACTURERS BRIEFS

Westinghouse Electric Corp plans to re-enter the room air-conditioning field in 1954 with a new line of the small units. Westinghouse has been out of the field since 1942.

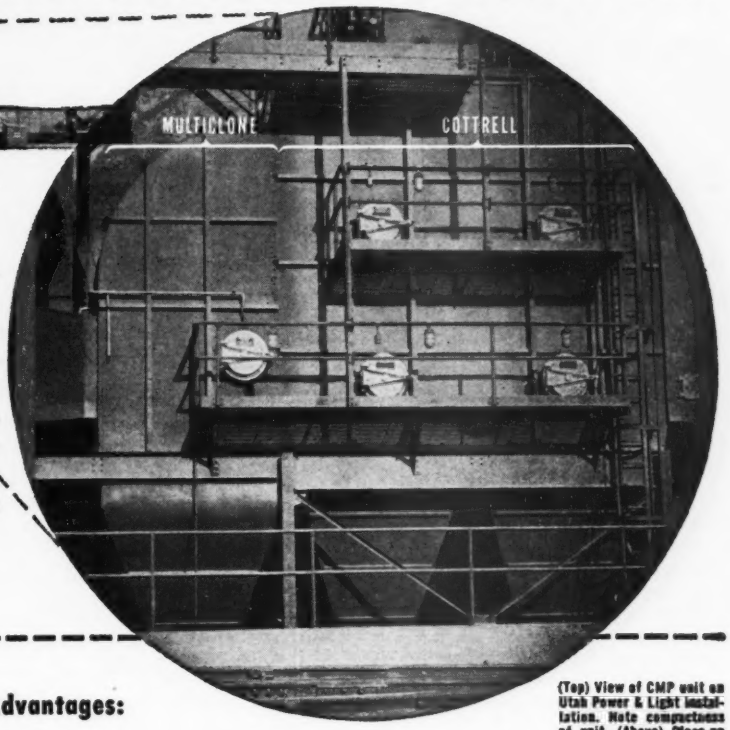
General Electric Co has announced formation of two new units—a specialty transformer department and a ballast department. This move, which divides the former specialty transformer and ballast department in two separate organizations, is another step in GE's decentralization program.

BullDog Electric Products of Los Angeles has moved into its new plant, which provides 22,000 sq ft of floor space for warehousing and manufacturing electrical distribution equipment. The manufacturing operations will fabricate and assemble electrical products for local requirements. The firm acts as factory representative in southern California and Arizona for BullDog Electric Products Co, Detroit.



Consider these important advantages of a WESTERN PRECIPITATION CMP UNIT!

IF YOU are planning the installation of any type of fly ash recovery equipment—mechanical or electrical—it will pay you to investigate the extra advantages to be gained by installing a CMP Unit designed, engineered and constructed under *one* responsibility by Western Precipitation Corporation—*leaders in both electrical and mechanical recovery fields!*



(Top) View of CMP unit on Utah Power & Light installation. Note compactness of unit. (Above) Close-up of same installation.

Combines Mechanical and Electrical Advantages:

A CMP (Combination Multiclone-Cottrell Precipitator) Unit combines—in one compact installation—both mechanical and electrical recovery principles, so that maximum benefit is obtained from the advantages inherent in each method. The MULTICLONE section centrifugally cleans the gases of the larger and heavier fly ash particles (down to a few microns in diameter) . . . and the COTTRELL Precipitator then electrically removes the very small particles remaining in the gases. This combination arrangement has important advantages:

1. Using the MULTICLONE for cleaning out the heavier particles permits the bulk of the recovery operation to be performed with relatively low-cost equipment.

2. Using the COTTRELL for final clean-up insures unusually high recovery efficiency—approaching theoretically perfect, if desired—with a high efficiency, compact Precipitator unit.

3. Each type of unit—MULTICLONE and COTTRELL—can be arranged for its most efficient application. MULTICLONES may be connected to each separate boiler, if desired, and their draft requirement cut out when the boiler is down . . . while a central COTTRELL handles all gases and operates at higher efficiencies, with continued low power cost, when one or more boilers are down.

4. During soot-blowing periods, or while warming up cold boilers, the MULTICLONE efficiency usually increases, preventing overloads of detrimental carbon from reaching the COTTRELL.

Only Western Precipitation Combines Multiclone and Cottrell "Know-How"—In ONE Organization!

A vital factor in obtaining maximum efficiency and economy in CMP installations is the proper balance of mechanical and electrical recovery equipment to the individual requirements of *each* application. Western Precipitation is unique in that it not only pioneered the commercial application of COTTRELL Electrical Precipitators over 43 years ago, but also has been a leader for many years in the *mechanical* recovery field with its widely-recognized MULTICLONE Collectors.

Result—Western Precipitation has the all-important "know-how" and experience in BOTH fields . . . knows from first-hand experience how to fit the *right* equipment in the *right* place, to do *your particular* job . . . and can provide the complete installation under ONE responsibility and ONE overall guarantee!

Let Our Experienced Engineers study your recovery requirements and make recommendations on the equipment best suited to your operations. A wire, phone call or letter to our nearest office places this unique "Know-How" at your service, without obligation!

Send for descriptive literature!

WESTERN Precipitation CORPORATION

ENGINEERS, DESIGNERS & MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

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GOLD SEAL TAPE

GUARANTEED FOOTAGE — you get full measure in every roll.

NO WASTE — Gold Seal Friction Tape tears evenly, does not ravel, conforms closely to uneven surfaces. Selected base cloth is made to high strength specification.

HIGH DIELECTRIC STRENGTH — Less footage is needed per job with Gold Seal Tape. No pinholes . . . one thickness insulates.

LASTING "TACK" — adhesive compound is prepared under laboratory control; this means that Gold Seal will stick to the job under severe conditions of cold and moisture.

EASY HANDLING — Gold Seal does not peel, dry out or smear the hands in hottest weather.

CELLOPHANE-WRAPPED — Keeps Gold Seal Tape factory-fresh until you're ready to use it.

PACKAGED FOR CONVENIENCE — in single rolls or handy 10-roll containers, it's the best buy in tapes. Jenkins Bros., (Rubber Division), 100 Park Ave., New York 17, New York.

JENKINS

Gold Seal Tape

FRICTION . . . RUBBER

MADE BY JENKINS BROS. . . .
MAKERS OF FAMOUS JENKINS VALVES

SALES ASSIGNMENTS

COMPANY STAFFS

Westinghouse Electric Corp's new Mid-America Region, Chicago, has made the following appointments: Marvin V. Maxwell, manager of engineering and service department; Harry H. Chapman, manager of the electric utility department; and H. L. Martin, assistant to district manager A. M. Fisher. Fisher, regional industrial department manager since 1949, is being replaced by V. S. Acton. The former Northwestern district was renamed Mid-America Region.

Sylvania Electric Products, Inc, has named Tom H. Cashin district sales manager in the Buffalo district of the Lighting Division. Cashin formerly was assistant district sales manager of the Philadelphia district.

General Electric Co has appointed R. H. Jackson manager of sales for the Southeastern district of its Apparatus Sales Division. He will have on his staff M. O. Troy, Jr, manager of apparatus product sales; B. D. Casey, Jr, manager of component product sales; and J. F. Baker, manager of industrial sales.

A. O. Smith Corp's Permaglas-Heating Division has named the following new district sales managers: Northeastern district, W. T. Halket, Springfield, Mass.; Eastern, W. A. Dunn, Teaneck, N. J.; Mid-Atlantic, H. N. Johnson, Philadelphia; East Central, Kenneth O'Gorman, Pittsburgh; Southeastern, Wendell Fields, Jr., Atlanta, Ga.; Midwest, G. C. Spratt, Lafayette, Ind.; North Central, L. H. Hoelter, Chicago; Central, R. J. Ulvestad, Kansas City, Mo.; Southwest, J. W. Burleson, Dallas, Tex.; and Western, H. L. Bilsborough, Los Angeles.

Graybar Electric Co, Inc, has named S. M. Cook manager of the Milwaukee branch to replace R. J. Harkins, who is retiring. Cook has been manager of power apparatus and signal apparatus sales at Kansas City since 1947.

Unistrut Products Co, Chicago, has appointed George C. Foy to the newly created post of Mid-Western manager for metal framing covering a territory of 16 states. Foy, who has 23 years' experience in the electrical construction industry, will work out of district headquarters located in the firm's general offices at 1013 W. Washington Blvd., Chicago.

Anaconda Wire & Cable Co has assigned Robert T. Shiels, Jr, as district manager in the Dallas, Tex., territory. James Lord and Ray Galenbeck have joined Anaconda as salesmen to serve in Chicago and Seattle, respectively.

Line Material Co, Milwaukee, has appointed Thomas J. Chapman lighting engineer for its Mountain States Division with headquarters in Spokane. He will handle airport and street lighting sales in Colorado, Montana, Idaho, Oregon, Washington, Wyoming, Utah, and Alaska. In another division appointment, Robert J. Norton was made apparatus engineer with headquarters in Denver. His territory includes Colorado, Wyoming, Utah, and Idaho. Harold T. Brazil was appointed a field engineer to handle L-M sales in Montana, working out of Butte. He replaces

Crapo GALVANIZED STEEL STRAND

Strong... to support pole structures under adverse ice and wind loadings.

Rugged... to withstand the punishment incurred in construction and service.

Long-Life... provided by famous Crapo Galvanized heavy, ductile, tightly-bonded zinc coatings.

-and Economical, Too!

● Each size and grade of time-proved Crapo Steel Strand utilizes the superior tensile strength of steel to the fullest advantage. Next time, *specify Crapo Steel Strand* for guys, messenger and overhead ground wires . . . and *save on maintenance!*

REINFORCE and PROTECT YOUR CONDUCTORS with Preformed ARMOR RODS

Minimize wear and chafing . . . Absorb and dissipate vibration . . . Protect against arcing and flash-overs . . . Increase holding power against slippage . . . Lessen possibilities of corrosion . . . *Reduce overall maintenance costs.*

Contact your jobber of Crapo Galvanized Products or write direct for further information!

INDIANA STEEL & WIRE COMPANY
MUNCIE, INDIANA

Robert A. Balch, who has been transferred to Spokane. Harold T. Zamzow, manager of capacitor regulator sales, is the new Western apparatus manager. From his headquarters in San Francisco, he will supervise apparatus engineering activities in ten Western states. Earl M. Stitis was assigned as a field engineer to the San Francisco office, taking over part of the northern California sales territory handled by Edward J. Keogh. Gordon J. Griffith, field engineer, was transferred from Fergus Falls, Minn., to Milwaukee to take over the southern Wisconsin territory.

Honan-Crane Corp, Lebanon, Ind., has named Donald D. Brock sales engineer for the Kansas City area. He formerly was associated with Sinclair Refining Co, Kansas City.

Reliance Electric & Engineering Co, Cleveland, has assigned the following engineers to district offices: Donald L. Peterson, Cleveland; David H. Rush, Buffalo; John E. Harger, Detroit.

MEETINGS CALENDAR

Illuminating Engineering Society
National Technical Conference, Hotel Commodore, New York, Sept. 14-18.

Edison Electric Institute
EEI-AGA Accounting Division Organization Meeting, Hotel Statler, Detroit, Sept. 15-18; Accident Prevention Committee, Radisson Hotel, Minneapolis, Sept. 21-22; Prime Movers Committee, Detroit, Oct. 5-6; Transmission-Distribution Committee, Hotel Nicollet, Minneapolis, Oct. 8-9; Industrial Relations Committee, Fall Round-Table Conference, Sheraton Hotel, Chicago, Oct. 12-14; Meter-Service Committee, William Penn Hotel, Pittsburgh, Oct. 19-21; Electrical Equipment Committee, Jung Hotel, New Orleans, Nov. 2-3.

Northwest Public Power Association
Accounting Section, Monticello Hotel, Longview, Wash., Sept. 17-18.

Public Utilities Association of Virginias
Annual Meeting, The Greenbrier, White Sulphur Springs, W. Va., Sept. 17-20.

Maryland Utilities Association
Fall Conference, Cavalier Hotel, Virginia Beach, Va., Sept. 18-19.

Rocky Mountain Electrical League
50th Annual Fall Convention, Broadmoor Hotel, Colorado Springs, Colo., Sept. 20-23.

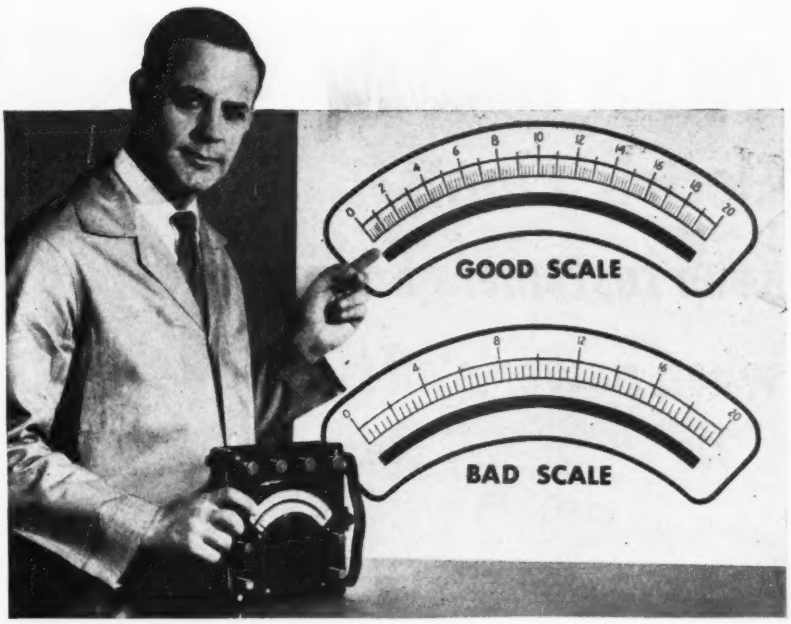
National Association of Railroad and Utilities Commissioners
Hotel Roosevelt, New York, Sept. 20-26.

Missouri Valley Electric Association
Accounting Conference, President Hotel, Kansas City, Mo., Sept. 21-22; Sales-Rural Conference, President Hotel, Kansas City, Mo., Oct. 7-9.

Instrument Society of America
8th National Instrument Conference-Exhibit, Sherman-Morrison Hotels, Chicago, Sept. 21-25.

International Association of Electrical Inspectors
Silver Jubilee Meeting, Edgewater Beach Hotel, Chicago, Sept. 21-26.

***Pennsylvania Electric Association**
Annual Meeting-Business Conference, Benjamin Franklin Hotel, Philadelphia, Sept. 22-23; Fall Meeting; Relay Committee, Iren Temple Country Club, Dallas, Pa., Oct. 1-2; Joint Meeting of Transmission-Distribution Committee and Electrical Equipment Committee, Abraham Lincoln Hotel, Reading, Pa., Oct. 8-9; Meter Committee Fall Meeting, Brunswick Hotel, Lancaster, Pa., Oct. 22-23; Fall Meeting, Systems Operation Committee, Castleton Hotel, New Castle, Pa., Nov. 5-6.



Why Westinghouse portable instruments are easier to read

Try this little experiment to find out for yourself why one of the two portable instrument dials shown above is easier to read than the other. Find 7 on each scale. Then try to locate 12.6. Pick any odd number or any number and decimal from 1 to 20 and find it on each scale.

Notice that you can read the scale at the top easily and accurately. The scale at the bottom is difficult to read. You have to puzzle over it and guess at some readings.

Laying out an instrument scale requires a great deal of thought and planning to avoid results like that shown in the lower scale. Poorly laid out scales like this are far too common. Westinghouse portable instruments are a pleasure to use because the scale divisions *are* well planned for fast, easy, accurate reading.

Another reason Westinghouse dials are easier to read is because they have an exclusive baked resin finish that stays white. It provides permanent protection against discoloring, crazing or chipping under all atmospheric conditions. This is especially important in portable instruments which are often carried from place to place and used under poor lighting conditions. J-40432

EVERYTHING YOU NEED IN METERS AND INSTRUMENTS

YOU CAN BE SURE...IF IT'S Westinghouse

FREE CATALOG For more information about the COMPLETE LINE of Westinghouse portable instruments, write for Catalog CS 43-100 or send this coupon to Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa.

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COMPANY_____

ADDRESS_____

CITY_____ STATE_____

ONAN Auxiliary Electric Plants

Keep customers happy when power's off!

Servicing sometimes requires that highline power be temporarily interrupted. Or storms, floods or fires may cut power to a factory, business or farm and cause severe losses.

To maintain and build customer goodwill in situations like these, many power companies use Onan Electric Plants as temporary sources of electricity. Mounted on truck or trailer they are rushed to the spot, hooked up and operating within a short time.

Onan Electric Plants are built for heavy-duty use to run continuously if necessary. They are trouble-free and economical to operate.

Having several sizes available is most economical since you can fit plant capacity to the electrical load. Onan gasoline-powered plants range from 1,000 to 50,000 watts. Diesel-powered: 3,000 to 55,000 watts.

A SIZE AND MODEL TO FIT ANY JOB

Model 10EL—10,000 Watts. Similar models to 50KW

Model 5GO—5,000 Watts. 4-cylinder heavy-duty engine

Model 305CK—3,500 Watts. 2-cylinder, air-cooled, engine

Write for specifications

Onan ELECTRIC PLANTS

D. W. ONAN & SONS INC.

8244 University Avenue Southeast Minneapolis 14, Minnesota

Electric Lines Club of New England
Fall Meeting, University Club, Boston, Sept. 23.

Public Information Program
West North Central Region, River Inn Hotel, Fergus Falls, Minn., Sept. 24; East North Central Region, Columbus, Ohio, Sept. 25; Mid-Atlantic Region, Baltimore, Md., Sept. 30; Steering Committee, Edgewater Beach Hotel, Chicago, Oct. 21; Workshop Conference, Edgewater Beach Hotel, Chicago, Oct. 22-23.

New England Meter Engineers
Fall Meeting, Casco Lodge, Casco, Me., Sept. 24-25.

American Institute of Electrical Engineers
Middle Eastern District Meeting, Daniel Boone Hotel, Charleston, W. Va., Sept. 29-Oct. 1; Conference on Application of Motors to Air-Moving Equipment and Symposium on Induction Motors, Hotel Van Orman, Fort Wayne, Ind., Oct. 6-8; Fall General Meeting, Muehlebach Hotel, Kansas City, Mo., Nov. 2-6.

National Electrical Industries Show
Sponsored by Eastern Electrical Wholesalers' Association, 69th Regiment Armory, New York, Sept. 29-Oct. 2.

Great Lakes Power Club
Plankinton House, Milwaukee, Wis., Oct. 1-2.

Southeastern Electric Exchange
Fall Meeting, Engineering-Operation Section, Carolina Hotel, Pinehurst, N. C., Oct. 1-2; Accounting Conference, Battery Park Hotel, Asheville, N. C., Oct. 15-16; General Sales Conference, Atlanta Biltmore Hotel, Atlanta, Ga., Nov. 19-21.

Interstate Power Club
Hotel Martinique, New York, Oct. 5; Hotel Martinique, New York, Dec. 7.

American Society of Mechanical Engineers
Fall Meeting, Sheraton Hotel, Rochester, N. Y., Oct. 5-7; Annual Meeting, Statler Hotel, New York, Nov. 29-Dec. 4.

Electric League of Western Pennsylvania
4th Industrial Electric Exposition, William Penn Hotel, Pittsburgh, Oct. 6-8.

Indiana Electric Association
Annual Convention, French Lick Springs Hotel, French Lick, Ind., Oct. 7-9.

Association of Edison Illuminating Companies
Annual Meeting, The Greenbrier, White Sulphur Springs, W. Va., Oct. 8-10.

National Association of Electrical Distributors
Fall Meeting, Pacific Zone, Hotel del Coronado, Coronado, Calif., Oct. 11-14.

Iowa Utilities Association
Management Conference, Hotel Fort Des Moines, Des Moines, Oct. 12-13.

Electrical Association of Philadelphia
Biennial Electric Progress Show sponsored by Manufacturers' Division, Convention Hall, Philadelphia, Oct. 13-15.

American Standards Association
4th National Standardization Conference and 35th Annual Meeting, Waldorf-Astoria, New York, Oct. 19-21.

University of Texas
Power Distribution Conference, Department of Electrical Engineering, Lower Colorado River Authority Auditorium, Austin, Oct. 19-21.

Oklahoma Utilities Association
Electric Light and Power Division, Eastern District, Vinita, Okla., Oct. 22; Western District, Norman, Okla., Oct. 23.

National Electrical Manufacturers Association
Annual Meeting, Haddon Hall, Atlantic City, N. J., Nov. 9-12.

Wisconsin Utilities Association
Electric and Gas Section Convention, Schroeder Hotel, Milwaukee, Nov. 11-13.

Pacific Coast Electrical Association
Annual Hawaiian Conference, Honolulu, T. H., Nov. 19-20.

Public Utilities Advertising Association
Region Two, Annual Meeting, Skytop, Pa., Dec. 10-11.

*Addition this week.

FPC Reversed

(*Continued from page* 98)

earlier court decisions, among them the Hope Natural Gas Co case wherein it was said:

"The record contains an abundance of evidence on subject of rate of return. The information includes investors' appraisal of the natural gas industry, comparative risk data, interest rates and yields on securities of natural gas and electric utilities, statistics showing the growth and stability of the natural gas industry, the trend of the cost of money and its current cost, commodity price indices, industrial production, employment, and payroll indices, Federal Reserve Bank discount rates, national income payments and other economic data, idle money statistics, the financial history of the Hope Company and the facts about recent financing by its parent Standard Oil Co. . ."

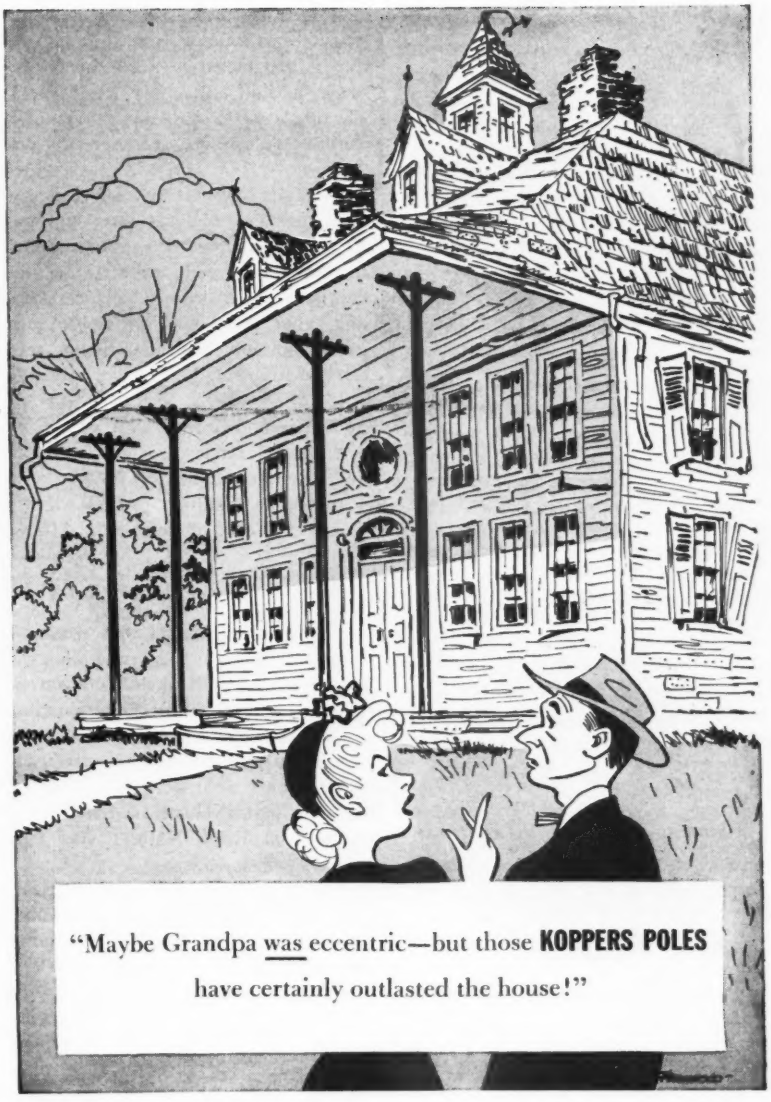
"In making the findings on rate of return, the national and international situations have commanded our attention and entered our deliberations. The commission is aware of the increased demands made upon Hope for gas due to the war program. Considering these matters, the underlying factors, and all of the evidence in the record, the commission finds that 6½% is the fair rate of return for the Hope Natural Gas Co. This rate of return being for the future has been set only after endeavoring to weigh all known and predictable elements. In setting it we have made allowance for presently unforeseeable contingencies."

It is of interest to note that in the early forties when money costs were substantially below those prevailing at present the FPC consistently found that a 6½% return was fair for natural gas pipeline companies.

By what logic can it now take the position of finding for a 5½% rate of return when various types of utility debt can only be sold at yields which are ¾% to 1% higher than in the earlier period? If 6½% was reasonable, then by the same token not less than 6½%, and undoubtedly more, should be reasonable now, especially when risks of this business have increased rather than diminished.

Court Takes Issue With FPC . . . The court also took issue with the FPC by saying that:

"In the case under review we are



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not given any indication that the commission has so exercised its practical, expert judgment. We are given instead a study that the commission has made as to the rate of yield of various natural gas companies. We know only from our own research of the records how those yields compare with those of other utilities, and we have no way of knowing how the commission would rate the risks in the company here under consideration and other companies. In a footnote to its opinion, the commission sets out the following:

56% bonds x 2.55% cost of borrowed money	1.43%
44% common equity x 9.25% return on common (including ½% cost of flotation)..	4.07%
	5.50%

"How much weight the commission ascribed to this equation, we cannot know. **It is obvious, however, that no rate of return determination can be set out so meagerly and have conclusive value"** (emphasis supplied).

The court went on to say that in the case of the Federal Power Commission vs Hope Natural Gas Co, 320 U. S. 591, 605:

"The Supreme Court makes it clear that there are **considerations beyond that of the yield to investor"** (emphasis supplied).

All of the foregoing indicates primarily one thing. The purely mathematical approach of yields, earnings price ratios, all mechanically composited, are sufficient and that consideration of the more important economical, financial and legal backgrounds, under which the utilities operate, so well set forth in the Bluefield and United Railways decision, must again be given a heavy weight in the determination of the rate of return.

No Out-and-Out Victory For Utilities ... Generally speaking it would seem that this decision is not an out-and-out victory for the utility industry. It is interesting to conjecture at this point as to what the court's decision would have been had the FPC given consideration to all the factors entering into the rate of return and having superficially complied with the letter but not the spirit of the law found the same 5½% that is arrived at by the simple statistical method which it

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actually used in its findings.

In this connection it should not be overlooked that the recent decision of the FPC granting the United Fuel Gas Co a 6¼% rate of return, while a step in the right direction, may have been a special answer to a special situation.

More than that it will have to be done especially for the electric utilities if the intent of the law and of economic equity is to be fully implemented. All utilities and especially the private electric industry have a major interest in the successful outcome of the problem which the Eighth Circuit Court has posed to the Federal Power Commission.

Colorado Utilities Win $11 Million Valuation Cuts

Protests by Colorado utilities have won them reductions from the increased valuations ordered against them recently by the Colorado Tax Commission (EW, July 20, p 44).

The 1953 tax valuations of major Colorado utilities were slashed more than $11 million after 23 utilities protested the new valuations. The original assessment announced in June was $318,030,750. This was cut to $306,818,830 after the protest hearings. The new total is still $13,761,530 higher than 1952 utility assessment of $293,057,300.

It was charged the original 1953 total resulted from improper classification of securities held by the corporations. Commission Chairman John Seaman said the classifications were clarified at the protest hearings of the tax commission.

The largest reduction from the June figure was granted Public Service Co of Colorado, state's largest single taxpayer. Its 1953 assessment was set originally at $69,596,440 and was cut $5,061,160 to $64,535,280. Southern Colorado Power Co received a reduction of $945,270 to $7,387,450.

Other electric utility reductions included Frontier Power Co, $1,022,580 to $942,020, a reduction of $80,560; Home Light & Power Co, $1,966,880 to $1,923,640, a reduction of $43,240; Wheatland Co-operative Electric, Inc, $29,290 to $11,590, a reduction of $17,700; and Colorado Central Power Co, $3,313,440 to $2,980,760, a reduction of $332,680.

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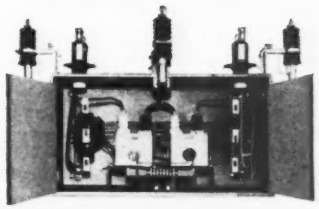

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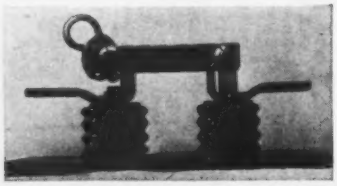

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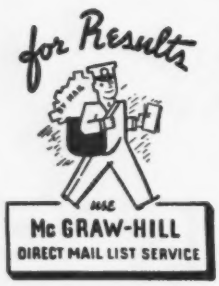

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Employee Fired . . .

. . . for alleged doubtful loyalty by Coast Counties G&E. ACLU protests committee authority

Coast Counties Gas & Electric Co has fired Donald Powers, an employee who refused to answer questions of the California state Senate Un-American Activities Committee during its probe of utility workers "of doubtful loyalty" (EW, Aug. 24, p. 104).

Said A. R. Bailey, Coast Counties vice president in charge of operations: "If he's innocent, he wasn't doing his job as a good citizen and we don't want him. If he's guilty, we don't want him either."

Earlier, five Pacific Gas & Electric Co employees who refused to answer committee questions on grounds of self-incrimination were given the option of resignation or dismissal. A PG&E spokesman said one resigned, and four had to be fired.

The committee, headed by Sen Hugh Burns (D, Fresno) recommended that the utilities fire the employees as "poor security risks."

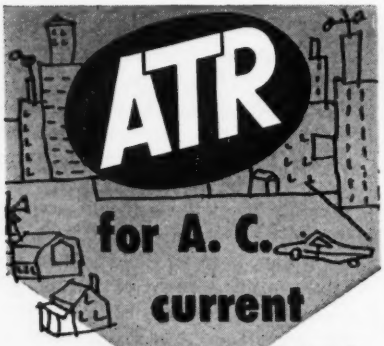
Authority Challenged . . . Meanwhile, the committee's authority to recommend dismissal of the employees and to urge establishment of a liaison between each private utility and the investigating committee to facilitate screening out of security risks was challenged by the American Civil Liberties Union of Northern California.

In a letter to Senator Burns they said the committee's authority is limited to finding facts and making recommendations which enable adoption of legislation to meet the problem. If committee members have evidence of crimes it is their duty as citizens to present the information to the proper agency for prosecution, the letter said.

Court Forestalls System Purchase by Paducah

Purchase by Paducah of power facilities of Kentucky Utilities Co within the city has been forestalled by a recent Circuit Court ruling.

The court held the purchase, provided for in an option clause of the utility's franchise, could not be consummated until a proper appraisal



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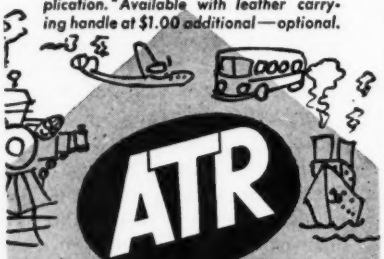

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of the property had been made and the value agreed on by appraisers appointed by both sides. The ruling made permanent a temporary injunction granted Kentucky Utilities restraining the city from placing the question of purchase on the November ballot. The utility has consistently opposed purchase of the properties.

Declaring the city had a right to purchase the facilities after a proper valuation had been made, the court granted the appraisers an additional six-month period in which to complete a "proper appraisal." If the two men cannot agree on property valuation within three months, the court directed that a third appraiser should be appointed.

Snake Basin Sites . . .

. . . to be resurveyed by Corps of Engineers as alternates to Hells Canyon Dam

New surveys of eight sites for multipurpose dams on the middle Snake River basin have been ordered by the Army Corps of Engineers to supplement earlier data.

All sites involve large storage factors vital to flood control and downstream generation, and some have been advocated as alternates to the controversial Hells Canyon dam spotlighted in recent Federal Power Commission hearings—which are slated to resume Sept. 21—on Idaho Power Co's proposal to build three low-head hydropower structures in the upper Snake basin.

In directing the Walla Walla, Wash., district office to undertake the studies, Maj Gen Samuel D. Sturgis, chief of the Corps, said Congress had provided $140,000 for the reports which are to be presented to Congressional committees next January.

Sites are Nez Perce and Mountain Sheep on the Snake; Crevice on the Salmon River; Kooskia, Forks and Penny Cliffs on the middle fork of the Clearwater River; and Elkberry and Bruces Eddy on the north fork of the Clearwater.

Corps, Bureau to Cooperate . . . Three—Nez Perce, Mountain Sheep and Crevice—had been assigned for study and future construction to the Bureau of Reclamation in a 1949 agreement between the Corps and the

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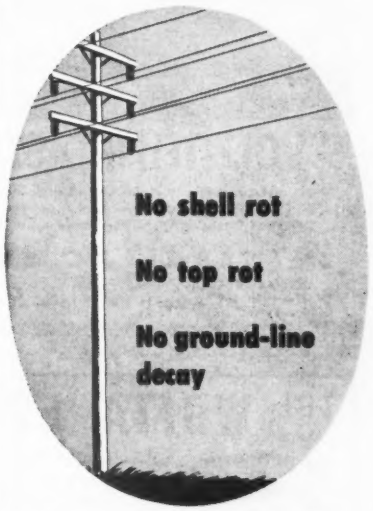

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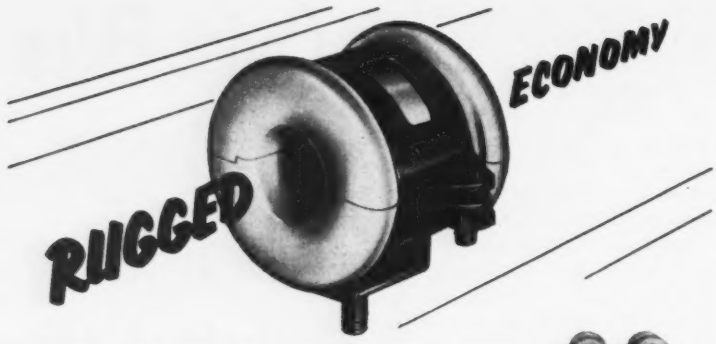

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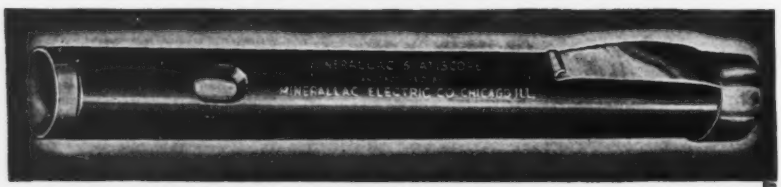

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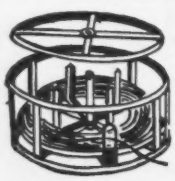

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Bureau. Both agencies will cooperate in the new reevaluation. In its 1950 survey of the Columbia basin, Corps had presented Nez Perce and Hells Canyon as jointly offering maximum storage benefits from the middle Snake; Crevice the best adapted to development on the Salmon; the Kooskia the best on the Clearwater system.

All four, however, have become involved in controversy aside from hydro-power questions. Hells Canyon storage potential has stirred up-river irrigation advocates who foresee water rights being infringed by power requirements; Crevice and Nez Perce because these would create barriers against salmon runs to spawning grounds claimed by fish interests to be the finest in the Columbia's upper basin area; and Kooskia because it would flood four towns and 183 miles of roads in the rugged Idaho mountains where route location is valued. The Forks site is an alternative to Kooskia and other alternatives include combinations of Elkberry on the north fork and Penny Cliff on the middle fork of the Clearwater.

NAEC Heads Lobbying List in Washington

Electric utilities—publicly, privately, and cooperatively-owned—reported spending more than $390,000 during the first six months of this year in connection with lobbying activities in Washington.

Total reported spending by all registered lobbies in Washington during the period was $2,337,000. National Association of Electric Companies again lead the list of lobbies with a total six-month outlay of $268,937.03, compared with $232,877 for the same period of last year. During the second quarter, NAEC reported receipts of $102,283.66.

Only other organization directly interested in power legislation reporting for the period was National Rural Electric Cooperative Association with an outlay of $18,311.71. This is a small part of the $503,281.50 which NRECA has budgeted for all of its activities during the current year.

American Public Power Association was not listed in the published report, but two of its representatives were. General Manager Alex M. Radin reported receipts for the second quarter

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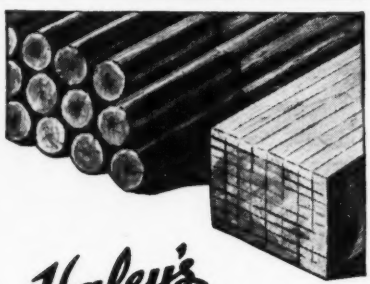

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of this year at $2,500 and general counsel Northcutt Ely reported receipts of $1,500 for the same period.

Sam O'Neal, public relations counsel, reported receipts totalling $1,875 for the first quarter of this year in connection with services rendered power distributors information committee of Tennessee Valley Public Power Association. He was not listed in the current report.

Municipal Utility Wins Battle Against Mussels

Los Angeles Department of Water and Power finally has won its battle against bay mussels. The successful struggle was described by H. T. Duplice, superintendent of Harbor Steam Plant, at a recent meeting of American Society of Mechanical Engineers on the West Coast.

Mussels and other organisms had been blocking the conduits that bring cooling water into the Harbor plant. The problem did not present itself until 1950 when a program to minimize harbor pollution began to show results. Previous to 1950 the organisms were killed when petroleum and manufacturing industries emptied high sulfides into the waters. With the anti-pollution drive, hydrogen sulfide concentration decreased and as oxygen in the water increased marine life began to thrive.

The Department of Water and Power has licked the problem by killing marine life while it is still young so the shells can pass through the cooling system without lodging there. Both ends of one of the plant's two circulating water conduits is sealed off for five to seven days every four weeks during the spawning period of the bay mussel. The mussels consume the oxygen in the closed-off water and die when there is no more. Test of the method occurred the first time the stop-log of the tunnel was raised. Result: 45 tons of dead marine life.

Tunnel Operations Set

Holing through of the tunnel from Eklutna Lake to the site of a $30 million hydroelectric plant near Palmer, Alaska, is scheduled for sometime in October. More than three-fourths of the four-and-a-half mile project is completed.

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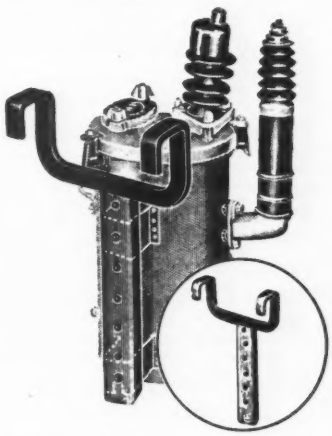
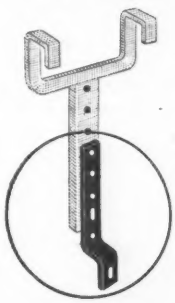


Model	1-Phase	3-Phase	Weight
T-1	3-15 KVA	9 KVA	16¼ lbs.
T-2	25-37-50 KVA	15-45 KVA	27¼ lbs.

HANGER KICKERS



Model K-1 for use with T-1 hanger. Adjusts to four positions. Model K-2 for use with T-2 hanger adjusts to five positions. Kickers and bolts are hot-dip galvanized.

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P-8922, Electrical World
330 W. 42 St., New York 36, N. Y.

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P-8926, Electrical World
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3— 500 KVA G-E 22000-2300/4000Y
3— 333 KVA W-H 13200-2400/4160Y
3— 333 KVA W-H 6600-2300
3— 333 KVA Mol 7200/12470Y-2400/4160Y
3— 250 KVA G-E 6600-575
3— 150 KVA G-E 19050/33000Y-2540/4000Y
2— 150 KVA G-E 6900-230/460
3— 100 KVA G-E 33000-6900/11950Y
3— 100 KVA G-E 4000-115/230
3— 50 KVA A-Ch 33000-6900/11950Y
3— 50 KVA A-Ch 33000-2400/4160Y

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1324 W. CERMAK ROAD
CHICAGO 8, ILL.

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CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

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POWER PLANT Chief Engineer for prominent midwest municipal electric and water utility. Graduate mechanical engineer with knowledge and experience in modern boilers, turbines and auxiliary equipment required. Knowledge of electrical circuits and equipment desirable. Age 30 to 40 years. Apply P-8957, Electrical World.

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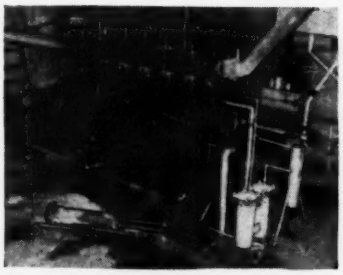

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450	G. E. (3-u.)	2300	125/250
400	A. C.	2300	120/240
300	Cr-Wh	440	250
300	G. E.	440	550
200	West.	2300	275
200	G. E.	440	600
150	G. E.	2300/440	250
150	G. E.	2300/4000	125/250
150	G. E.	440	275
125	G. E.	440	300
125	West.	440	250
100	G. E. (25 cy)	440	125
100	G. E.	2300	250
100	Ridgway	2200	275
100	West.	220	125
100	Elec. Machy	220	125
90	G. E.	220	250

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1—1000	Moore	Condensing—Extraction—190 lbs., 2400-3-60—Surface Cond.
1—750	G.E.	Condensing—265 lbs., 440-3-60 Built 1944
1— 500	Moore	Non-Cond—150/200 lbs., 5/35 lbs. B.P., 480-3-60 Dir. Conn. Exciter
1— 400	Westgh.	Non-Cond—125/150 lbs., 5/10 lbs. B.P., 240/480-3-60
— 300	G.E.	Non-Cond—150/175 lbs., 5/10 lbs. B.P., 480-3-60

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Qu Kva	Make	Cycles	Voltages
1—12500	Whse.	25/60	13200 x 13200
1—3750	G.E.	25/60	4150/2400 x 2400/4150
1—3125	G.E.	25/60	4150/2400 x 2400/4150
2—2500	G.E.	25/62½	2300 x 4160
1—1250	G.E.	25/58.3	4400 x 2300
1—625	A.C.	25/60	11000 x 2300

MOTOR GENERATOR SETS

3 ph, 60 cy.

Qu KW	Make	Speed	DC Volts	AC Volts
1—3000(3U)	G.E.	514	600	4000/13200
2—2000	G.E.	450	250	2400
2—2000	G.E.	514	600	6600/13200
1—2000	G.E.	500	666 25 cy.	11000
2—1750	G.E.	514	250	2400
1—1500	C.W.	514	115	4000/13800
1—1500	G.E.	720	600	13200
1—1500	G.E.	600	600	2300/4150
1—1000	G.E.	900	260	4100/6900
2—1000	Whse.	900	600	2300/4150
1— 750	Whse.	900	275	2300/4150
1— 500	Whse.	1200	125/250	2300
1— 500	Whse.	900	250	440
1— 500	G.E.	720	125	2300

TRANSFORMERS—60 Cycle

KVA	Make	Type	Ph	Voltages
1—5000	Whse.	OISC	3	33000x26400/13200
1—2500	Whse.	OISC	3	26400/13200 x 480
3—1250	G.E.	HVDDJ		6600x550
1—1150	A.C.	OISC		3200x480/2400
3—1000	G.E.	HVDDJ	1	2200/480

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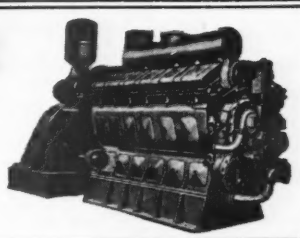

A PARTIAL LISTING OF OUR INVENTORY

KW	Make	Model	HP	RPM	KW	Make	Model	HP	RPM
1980	Nordberg	TS-217	2800	225	320	Enterprise	DSG-6	560	450
1136	Fairbanks Morse	38D	1600	720	300	General Motors	8-268A	450	1200
1100	General Motors	16-278A	1600	720	200	General Motors	8-268A	350	900
750	General Motors	12-567	1080	720	150	Worthington	CC-4	225	450
500	Baldwin	VO-8	750	514	150	Ingersoll-Rand	S-4	225	600
500	General Motors	8-278A	750	720	150	Buckeye	80	240	600
500	General Motors	8-567	720	720	100	Worthington	BB-5	150	600
480	Worthington	DD-8	700	360	100	General Motors	3-268A	150	1200
400	Ingersoll-Rand	S-8	600	720	60	General Motors	6-71	90	1200
350	Baldwin	VO-6	510	450	30	Internat'l Harvester	UD-14	45	1200

A. G. SCHOONMAKER COMPANY, INC.

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FOR SALE

40,000-KW TURBO-GENERATOR SET

Together with its steam generators and auxiliary electrical and mechanical equipment. Now in service but available for removal late this year.

FS-8985, Electrical World
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- for every industrial and power application.
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- Large stocks on hand of high voltage, lead covered cables not ordinary stocked by your regular supplier.
- Cut to length. Reasonably priced.

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2—3125 KVA, 14400 — 2400/4160 Volt, General Electric Company, single phase oil insulated, water cooled, 4—600 volt taps below 14400; suitable for 3 to 3 or 3 to 2 phase operation; serial nos. 1468704 & — 5.

1—2000 KVA, 69600Y — 2400 Delta, Three Phase Moloney Electric Company, oil insulated, self cooled, 5—2400 volt taps below 69600.

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TURBO GENERATOR

Available Immediately
7500 KW G.E. Co.
180 P.S.I.—525°F Total Temp.
3 phase 60 cycle 2300 volt
With Surface Condenser
GOOD CONDITION

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2— 400 KVA Pitts., 1 Ph., 2400/4800V. 240/48V.
3— 333 KVA Whse., 1 Ph., 2400V. 600 V. sec.
2— 300 KVA G.E., 1 Ph., 13200V. 220/440V.
1— 200 KVA G.E., 3 Ph., 2400-220 sec.
3— 200 KVA G.E., 1 Ph., 13280V. 440V.

SYNCHRONOUS MOTORS

1— 300 H.P., Elec. Mach., 720 RPM, 3 Phase 60 cyc., 2200V T E F Cooled Outdoor service.
1— 150 H.P., G.E., 1800 RPM. 220V. 3/60.
2— 150 H.P., Al. Chal. 360 RPM, 440V. 3/60.

MOTOR GENERATOR SETS

1—1000 KW Whse., 600 V. 720 RPM, 4000 Syn.
1—1000 KW G.E., 600 V. 514 RPM, 4000 Syn.
1—1000 KW Whse., 275 V. 720 RPM, 4000 Syn.
1— 200 KW Whse., 250V., 900 RPM, 4000V. Syn.
1— 150 KW G.E., 126/250V, 1200 RPM, 2300 Syn.
1— 100 KW G.E., 250V. 900 RPM, 2300V. Syn.

SLIP RING MOTORS

2— 500 H.P., G.E., M 1200 RPM 2400 V.
1— 400 H.P., West., CW, 450 RPM, 550V.
1— 250 H.P., West.,CW, 600 RPM, 440V.
1— 200 H.P., West., CW, 600 RPM, 440V.
3— 150 H.P., Al. Ch. 1800 RPM, 2300V., 3PH, 60 Cy.

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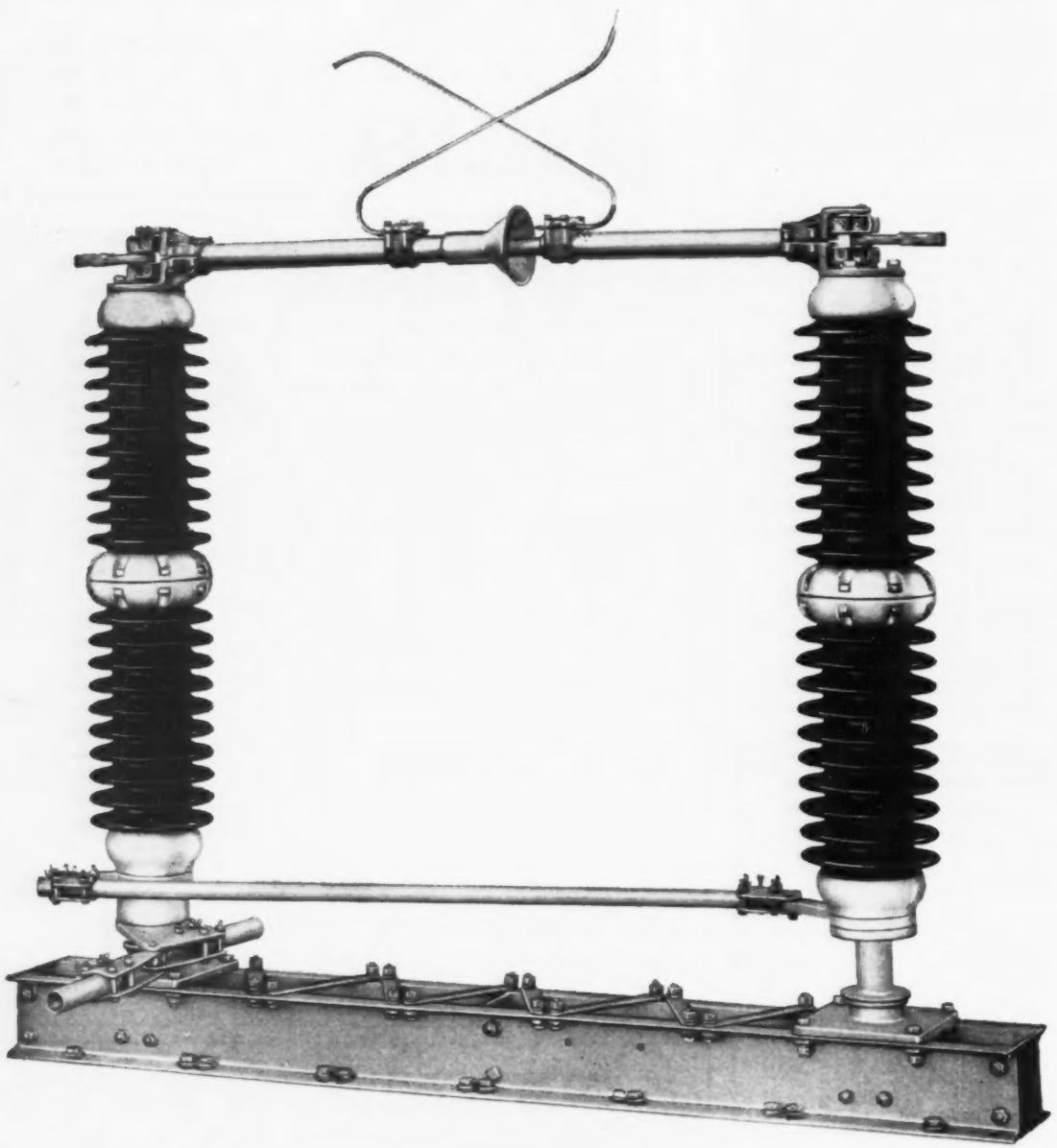

AIR BREAK DISCONNECTING SWITCH
115,000 Volts—600 Amperes—Type PU
Horizontal Mounting—Three Pole—Center Side Break—Group Operated
SILVER TO SILVER CONTACTS
One Pole Shown
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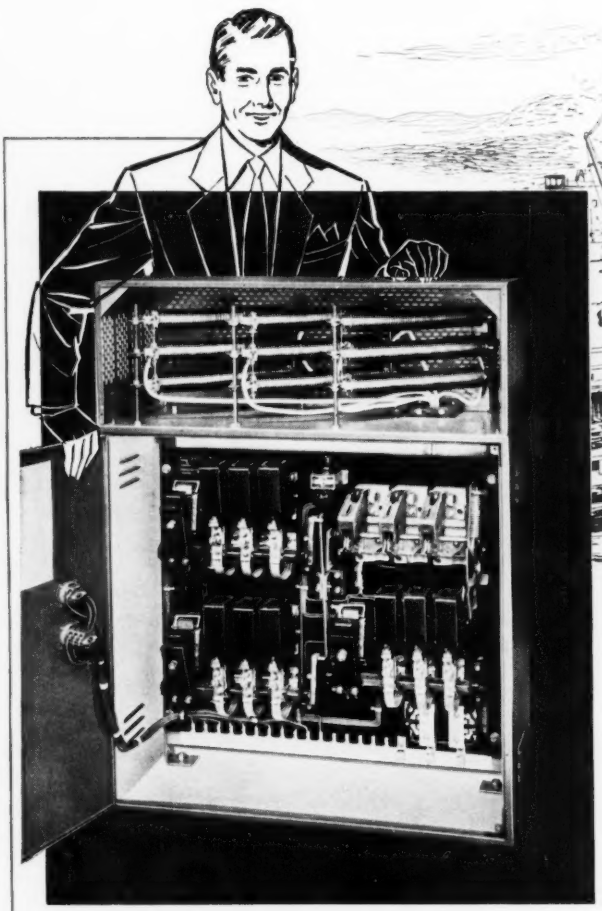
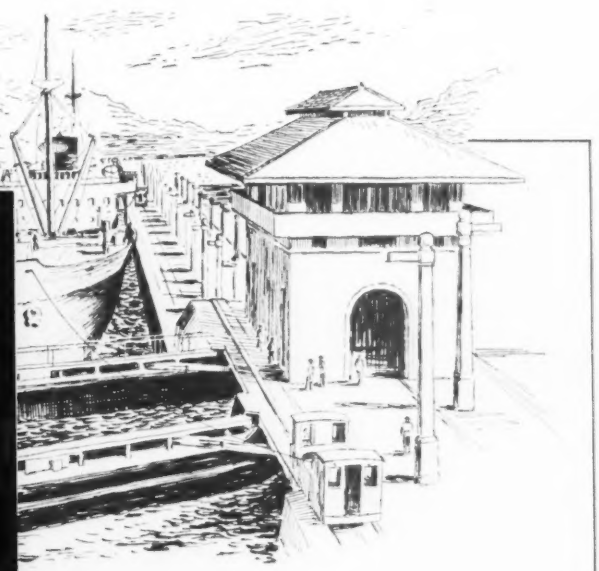
IT'S FEDERAL NOARK® MOTOR CONTROLS FOR THE PANAMA CANAL





ABOVE: View of the upper pair of the Miraflores locks and one of the control towers from which the new Federal Noark motor controls are operated.

AT LEFT: Interior view of one of the eight types of motor controls built for the canal project.

THE PANAMA CANAL is now undergoing an extensive modernization program. One phase requires new electric motor controls for the locks...and Federal Noark devices are being installed. These controls will assure the safe, efficient motor starting required for rapid and continuous canal service.

Special processes in the manufacture of these 398 motor controls were necessitated by the specifications. Wire insulation, for instance, and other parts likely to deteriorate under tropical conditions had to be protected against "attack by insects, especially cockroaches and termites," and made fungus-proof with suitable shellac. To accomplish this, Federal engineers treated each part separately before assembly.

Whether your control problems are simple or as complex as those for the Panama Canal, call in Federal Noark for the right solution.

Write Federal Electric Products Company, 50 Paris Street, Newark 5, N. J.

Plants at Newark, N. J.; Long Island City, N. Y.; Hartford, Conn.; Cleveland, Ohio; Gary, Ind.; St. Louis, Mo.; Dallas County, Texas; Los Angeles, Calif.; San Francisco, Calif.; Santa Clara, Calif. Affiliated plant, Toronto, Canada.

Federal Noark products: Stab-lok Circuit Breakers, Motor Controls, Safety Switches, Service Equipment, Industrial Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct — **Pacific Electric Manufacturing Corporation products:** High voltage circuit breakers and power switches ★ Sales offices in principal cities.

FEDERAL NOARK®

Federal NOARK

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These national standards include KVA ratings, dimensions and locations of standard accessory equipment, sizes and locations of terminals, nameplate data, connection diagrams and dimensions for standard auxiliary devices. Today Kuhlman Transformers not only meet these standards, but provide extra factors of efficiency, safety and reliability.

Kuhlman Transformers are soundly engineered and sturdily constructed for years of exceptional service. Kuhlman makes Power, Distribution, Dry Type, Saf-T-Kuhl, Subway, Series, and CSP in standard ratings for virtually every electrical application. Write us today for complete information.

Typical power transformer per ASA Standards. | Typical overhead distribution transformer per EEI-NEMA Standards. | Typical subway type transformer per EEI-NEMA Standards.

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